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PHYSICS ABSTRACTS

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ABSTRACTS 2093–2323

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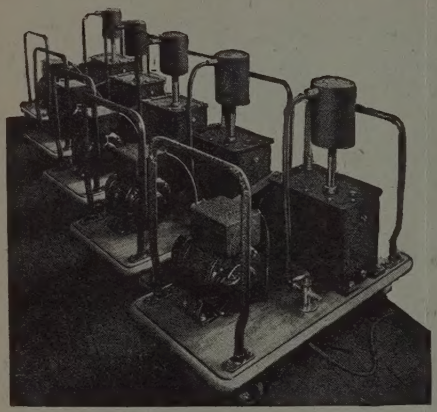

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159.93 2093

Ocular photography as a scientific approach to the study of the psychological aspects of seeing. BRANDT, H. F. *Illum. Engng, N.Y.*, 39, *pp.* 279–289, *May*, 1944.—By means of a cine camera which takes a film of 2 spots of light reflected from the 2 eyeballs, it is possible to record the successive points of fixation in scanning a page, and the period of each fixation. One application is to the study of advertisement display.

J. W. T. W.

159.93 : 531.2 *see Abstr.* 2112

513.28 = 4 2094

On a construction relative to the perspective of a circle. ROSSIER, P. *Arch. Sci. Phys. Nat.*, 26, *March–April* (*Suppl. No.* 1, *C.R. Soc. Phys. Hist. Nat., Genève*, 61, 1, *pp.* 16–17), 1944.—Gives a method for constructing points and tangents of a circle, proved to be valid for any conic.

513.432 : 531.731 *see Abstr.* 2115

517.564 : 530.12 *see Abstr.* 2108

517.564.3 : 621.392.1 : 517.947.44 = 3 *see Abstr.* 2095

517.947.44 : 517.564.3 : 621.392.1 = 3 2095

The wave-guide of circular cross-section with a dielectric insert. BUCHHOLZ, H. *Ann. Phys., Lpz.*, 43, 5, *pp.* 313–368, *Oct.*, 1943.—[Abstr. 1725 B (1944)].

517.948.34 : 539.185 : 533.15 = 3 2096

On plane diffusion problems. WICK, G. C. *Z. Phys.*, 121, 11–12, *pp.* 702–718, 1943.—An approx. method is developed, for solving the diffusion equation

$$\left(u\frac{\partial}{\partial x}+1\right)f(x,u)-\frac{\sigma}{2}\int_{-1}^{1}f(x,v)dv=0$$

where $\sigma = P_s/(P_s + P_a)$, P_a and P_s being the absorption and scattering coefficients. Write

$$\rho(x)=\int_{-1}^{1}f(x,u)du=\sum_i p_i f(x,u_i)$$

and let $u_1, u_2, \ldots, u_n$ be the n zeros in (0, 1) of the Legendre Polynomial $P_{2n}(u)$. Substituting for the integral in the original equation, we obtain the $2n$ differential equations

$$\left(1+u_i\frac{\partial}{\partial x}\right)f(x,u_i)-\frac{\sigma}{2}\sum_j p_j f(x,u_j)=0$$

for the $2n$ unknown functions $f(x, u_i)(i = -n, \ldots -1, 1, \ldots, n)$. It is shown that $f(x, u_i)$ may be written in the form $f(x,u_i)=\sum_m \frac{L_m}{1-k_m u_i}e^{-k_m x}$ where the k_m and L_m are constants. The k_m appear as the roots of $1=\sigma\sum_{i>0}\frac{p_i}{1-k^2u_i^2}$ and a method is given for obtaining the L_m. This analysis may be applied to a wide range of plane diffusion problems (such as arise in neutron physics). An expression is obtained for the albedo and, in particular, an elementary derivation is given of the exact formula $\rho_\infty/\rho_0 = (N+1)^{1/2}+1$. A table of numerical data is given to assist in applications of the approximate method. [See Abstr. 4946 (1936)]. L. S. G.

518.3 2097

Nomograms. NACHOD, C. P. *Gen. Elect. Rev.*, 47, *pp.* 13–20, *May*, 1944.—Describes the parallel-line log. nomogram, its principle and the method of graduating the scale. The principles are extended to the 3-, 4- and 5-variable cases. Examples are given.

M.-V.

518.3 : 531.753 *see Abstr.* 2117

518.3 : 532.73-1 *see Abstr.* 2133

518.3 : 535.338 2098

A nomogram for representing Balmer-type spectrum formulae. FREEMAN, I. M. *Amer. J. Phys.*, 12, *pp.* 169–170, *June*, 1944.

518.3 : 536.8 : 536.633 *see Abstr.* 2176

518.3 : 541.123.1.012 : 536.423.15 *see Abstr.* 2170

518.4 : 542.48 : 541.123.3 *see Abstr.* 2266

518.5 : 621.3.018.1 2099

Special slide rule. GORE, W. M. *Elect. Rev., Lond.*, 134, *p.* 808, *June* 9, 1944.—[Abstr. 1634 B (1944)].

518.5 : 681.14 : 535.51.06 *see Abstr.* 2156

519.5 2100

On non-denumerable graphs. ERDÖS, P., AND KAKUTANI, S. *Bull. Amer. Math. Soc.*, 49, *pp.* 457–461, *June*, 1943.—A theorem is proved on the decomposition of a complete graph and applied to show that the continuum hypothesis is equivalent to the proposition that the set of all real numbers can be decomposed into a countable number of subsets, each consisting only of rationally independent numbers [see Abstr. 810 (1944)]. L. S. G.

522.1 2101

Mount Wilson Observatory. ADAMS, W. S. *Carnegie Instn Yearb., No.* 42, *pp.* 3–22, 1942–1943.—Annual report.

522.1 2102

Astronomical studies at the Leander McCormick Observatory. MITCHELL, S. A. *Carnegie Instn Yearb., No.* 42, *pp.* 23–25, 1942–1943.

523.13 2103

Non-solar planetary systems. BANERJI, A. C. *Nature, Lond.*, 153, *p.* 779, *June* 24, 1944.—[See Abstr. 332 (1944)].

523.892.1 2104

Programme for the determination of systematic corrections to fundamental catalogues from observations of minor planets. BROUWER, D. *Carnegie Instn Yearb., No.* 42, *p.* 23, 1942–1943.

526.8 2105

The four-colour problem. BACKER, S. M. DE. *Nature, Lond.*, 153, *p.* 710, *June* 10, 1944.

53 : 681.2 2106

Physics and the scientific-instrument industry. PHILPOT, A. J. *Proc. Phys. Soc., Lond.*, 56, *pp.* 263–270, *July*, 1944.

53.081 = 4 2107

Universal constants, natural units and relativistic invariance. MERCIER, A. *Arch. Sci. Phys. Nat.*, 25, *Sept.–Dec.* (*Suppl. No.* 3, *C.R. Soc. Phys. Hist. Nat., Genève*, 60, 3, *pp.* 214–218 *and* 256–262), 1943.—

Arguments are given, in the first paper, for the necessity of a fourth universal const. in addition to h, the Boltzmann constant, k, and the velocity of light, c. In the second paper it is shown that relativistic invariance suggests that 5 universal constants would be required to express all physical relationships. In addition to the 3 mentioned above, a fourth is the electronic charge, e. The fifth is still unknown.

A. J. M.

530.12 : 517.564 2108

Special theory of relativity in hyperbolic functions. KARAPETOFF, V. *Rev. Mod. Phys.*, 16, *pp.* 33–52, *Jan.*, 1944.—The author develops the use of rapidities in place of velocities and introduces festinations in place of accelerations. A simple universal distortion factor is deduced in hyperbolic notation, and symmetrical expressions are derived for mechanical force, momentum and energy. The theories of aberration of light and of Fizeau's experiment are used to demonstrate the advantages of hyperbolic functions in relativity. The invariance of Maxwell's equations for the two observers in relative motion is proved (*a*) by the method of paired functions, and (*b*) by using divergence and curl in a semihyperbolic 4-dimensional space.

530.145.6 = 3 2109

Observable quantities in the theory of the elementary particles. I–II. HEISENBERG, W. *Z. Phys.*, 120, 9–10, *pp.* 513–538, *and* 11–12, *pp.* 673-702, 1943.—A new approach is presented for studying problems involving elementary particles. This is based, not on the Hamilton function, but on the so-called η-matrix given by $S = e^{i\eta}$ where S is the matrix associated with the physical quantity under discussion. In contrast with the usual quantum theory of wave fields, the new method avoids all divergence difficulties and enables problems of the scattering, absorption or emission of elementary particles to be treated rigorously. The physical consequences of the theory are examined and the results are consistent with relativity theory. [See Abstr. 2110 (1944)]. L. S. G.

530.145.6 : 541.651 = 3 2110

Radiation properties and energy spreading for closely packed similar atoms. MÖGLICH, F., AND ROMPE, R. *Z. Phys.*, 120, 11–12, *pp.* 741–772, 1943.—A wave-mechanical treatment. Approx. wave functions are found for an assembly of similar atoms and the transition probabilities are calculated. The latter are used to explain the emission and absorption of the single atoms and the resonance fluorescence of the assembly is studied. The results are used to give an interpretation of observations on linear dye polymers [Abstr. 1206 (1938)]. L. S. G.

530.145.63 2111

An unambiguous method of avoiding divergence difficulties in quantum theory. STUECKELBERG, E. C. G. *Nature, Lond.*, 153, *pp.* 143–144, *Jan.* 29, 1944.—The author has succeeded in relating the usual quantum theory of wave packets to the recently proposed method of Heisenberg [Abstr. 2109 (1944)] which permits the calculation of collision cross-sections without the difficulty of diverging terms. The result is equivalent to a quantum-theoretical interpretation of the classical particle theory of Dirac [Abstr. 3660 (1938)]. An application is made to the line broadening, due to radiation damping, of a classical point particle. L. S. G.

531.2 : 159.93 2112

The concept of force. GREGORY, J. C. *Nature, Lond.*, 154, *p.* 24 *July* 1, 1944.

531.259 2113

On plane rigid frames loaded perpendicularly to their plane. PRAGER, W., AND HAY, G. E. *Quart. Appl. Math.*, 1, 1, *pp.* 49–60, *April*, 1943.—Methods are developed for the stress analysis of such frames. The analogy between the statics of plane-loaded frames and the kinematics of space-loaded frames is discussed and used to determine the influence lines for the stress resultants of a space-loaded frame. The analogy between the kinematics of plane-loaded frames and the statics of space-loaded frames is next treated. It may be used to find the stress resultants of a space-loaded frame by determining the displacements of the conjugate plane-loaded frame. Once these have been found, the method of the first analogy may be used to find the elastic deformations of the space-loaded frame. A method using the inverse column analogy is also given for determining the stress resultants of indeterminate space-loaded frames and their influence lines. L. S. G.

531.717.1 : 621.317.49 2114

Electromagnetic measurement of thickness. HUTTER, H. E. *Elect. Times*, 106, *pp.* 4–5, *July* 6, 1944.—[Abstr. 1679 B (1944)].

531.731 : 513.432 2115

The calculation of the volumes contained in the partially filled dish ends of horizontal cylindrical tanks. BLACKMORE, H. A. *J. Inst. Petrol*, 30, *pp.* 167–170, *June*, 1944.—Approx. formulae giving the vol. of liquid as function of depth are given.

531.743 : 539.262 *see Abstr.* 2237

531.75 : 542.3 2116

Microchemical balances. CORWIN, A. H. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 258–269, *April* 20, 1944.—Methods are described for the location and reduction of errors. These fall into two groups, those varying with the environment (due to temperature gradients in the balance case, to humidity changes, to uniform temp. changes and to magnetic influences) and those due to reading, to imperfection of knives, to poor arrestment design, to poor rider design, and to imperfect machining of the rider notches.

531.753 : 518.3 2117

Nomographic chart for correcting weights to vacuum. THACHER, H. C., JR. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *p.* 275, *April* 20, 1944.

531.761 : 621.317.39 2118

Apparatus for measuring short time intervals. *Engineering*, 157, *pp.* 445–448, *June* 9, 1944. *See also J. Sci. Instrum.*, 21, *pp.* 144–145, *Aug.*, 1944.—[Abstr. 1674 B (1944)].

531.787 : 578.087 2119

A manometric valve or respirator. CANTOR, A. *Science*, 100, *p.* 16, *July* 7, 1944.

531.787.3 : 534.115 *see Abstr.* 2136

531.788.7 2120

Use of the ionization gauge on systems evacuated by oil diffusion pumps. BLEARS, J. *Nature, Lond.*, 154, *pp.* 20–21, *July* 1, 1944.

532.01 : 536.7 2121

The hole theory of liquids. AULUCK, F. C., AND KOTHARI, D. S. *Nature, Lond.*, 153, *p.* 777, *June* 24, 1944.—[See Abstr. 2369 (1941)].

532.13 : 532.14 2122

Viscosities and densities of hydrogenated cottonseed oils. WAKEHAM, H., AND MAGNE, F. C. *Industr. Engng Chem.*, 36, *pp.* 568–570, *June*, 1944.

532.133 : 541.182 = 3 *see Abstr.* 2290

532.137 : 539.501 : 541.182.025 *see Abstr.* 2293

532.14 : 532.13 *see Abstr.* 2122

532.517.4 2123

A review of the statistical theory of turbulence. DRYDEN, H. L. *Quart. Appl. Math.*, 1, 1, *pp.* 7–42, *April*, 1943.—A connected account is given of the present state of the statistical theory of turbulence [Abstr. 4003 (1936)]. This theory is applicable to continuous movement and satisfies the equations of motion. Isotropic turbulence and its decay is discussed in considerable detail, and there is a description of the correlation tensor function of von Kármán [Abstr. 457 (1938)]. The spectrum of turbulence [Abstr. 953 (1938)] and its relation with the correlation is discussed, as well as the diffusive character of turbulence. L. S. G.

532.525 : 534.321.9 *see Abstr.* 2138

532.542.1 2124

Isothermal pressure drop for two-phase two-component flow in a horizontal pipe. MARTINELLI, R. C., BOELTER, L. M. K., TAYLOR, T. H. M., THOMSEN, E. G., AND MORRIN, E. H. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 139–151, *Feb.*, 1944.—The static pressure drop accompanying isothermal 2-phase 2-component flow of air and 8 various liquids, incl. benzene, water and S.A.E. 40 oil, was measured for conditions varying from all air to all liquid in a 1 in. glass pipe and a ½ in. galvanized-iron pipe. The flow patterns existing at the various flow rates were studied visually and photographically. A macroscopic analysis of the flow phenomenon is presented, which allows the prediction of given conditions. The application of the proposed method to the prediction of pressure drop along a pipe in which a fluid is evaporating is tentatively outlined.

532.57 2125

Positive displacement flowmeter. MCAFEE, J. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *p.* 303, *May*, 1944.

532.61.08 2126

A centrifugal method of measuring the surface tensions and interfacial tensions of liquids in capillary tubes. MEYERSTEIN, W., AND MORGAN, J. D. *Phil. Mag.*, 35, *pp.* 335–342, *May*, 1944.—Prior to this investigation, one of the authors (W. M.) had devised a simple method of filling haematocrit capillary tubes which consisted of a small cup formed on or secured to the open end of the capillary tube and having sufficient capacity to hold a small quantity of the filling liquid, the arrangement being then spun in a centrifuge. At a particular speed the liquid in the cup passed into the tube suddenly, and the tube could be emptied by reversing the position of the open end relatively to the axis of rotation. This method has been made the basis of one now described for measuring the surface tensions of liquids, and particularly of interfacial tensions. The theory of the method is worked out on the assumption that the meniscus is hemispherical. Bubble phenomena are described which provided an alternative method to the former one which was based on filling and emptying data. The methods discussed are particularly useful when only small quantities of liquid are available.

H. H. HO.

532.612 2127

Van der Waals' cohesion constant. AULUCK, F. C., AND RAI, R. N. *Curr. Sci.*, 13, *pp.* 126-127, *May*, 1944.—The Schrödinger equation for a "hole" in a liquid is solved. The energy values E_n are given approx. by $E_n = 3{\cdot}61(n + 0{\cdot}7)^{4/7}\sigma^{5/7}h^{4/7}\rho^{-2/7}$. The theory gives for the intrinsic pressure and van der Waals' cohesion const. $p_0 = 2{\cdot}4\sigma(\sigma\rho/h^4)^{1/7}$, $a = 2{\cdot}4V^2\sigma(\sigma\rho/h^4)^{1/7}$, where V is the mol. vol. of the liquid. The variation of a with σ and ρ is as required by the theory, but the const. of proportionality is nearly 0·6 times its theoretical value. [See Abstr. 3082 (1940)].

532.613.4 2128

Rupture of water drops over liquid surfaces. SINGH, B. N., AND SINHA, S. P. *Bull. Patna Sci. Coll., No.* 14, *pp.* 132–136, *Jan.*, 1944.—When liquid drops fall over a solid or liquid surface, they are distorted after impact and extremely rapid oscillations are produced in them. If the distortion is beyond a certain limit, rupture of the drops takes place. Observations are recorded which are visually possible, and on drops of water falling under gravity from different heights upon surfaces of different liquids. The nature of the latter was varied as follows: liquids heavier or lighter than drops and non-miscible or miscible in them, for which purpose kerosine, olive, transformer and castor oils were used. Experimental details with data are given from which the following conclusions are drawn: (1) For a given liquid, the critical height decreases with the increase in weight or radius of the falling drops. (2) The rate of decrease of critical height with weight or radius also decreases with the increase in the weight or radius of the drops. (3) For a given size of the drop, the critical heights are different for different liquids, and these differences become less marked with increase in size. Even with large radii or weight the critical height does not tend to a zero value. H. H. HO.

532.62 : 535.247.4 *see Abstr.* 2141

532.66 2129

Rate of rise of water in capillary tubes. RENSE, W. A. *J. Appl. Phys.*, 15, *pp.* 436–437, *May*, 1944.—The character of the rise of water in a capillary tube is explained on the assumption that the rise is turbulent, and the results are verified with measurements from stroboscopic photographs. The equation for the rise if it is turbulent is found to be $z = \text{constant} + (1/k^2)\log t$, where z is the length of a cyl. section of the water and t is the time. For a capillary tube of radius 0·0316 cm. the resulting curve was best represented by $z = 4{\cdot}65 + 1{\cdot}04\log t$. The results suggest a dynamic method for finding Reynolds's number.

H. H. HO

532.685 : 551.579.5 2130

Pressure-plate apparatus for measuring moisture sorption and transmission by soils. RICHARDS, L. A.,

AND FIREMAN, M. *Soil Sci.*, 56, *pp.* 395–404, *Dec.*, 1943.—A cell employing a porous ceramic plate for measuring the relation between moisture content and moisture tension in soil samples over the soil-moisture tension range from 0–2 atm. is described. The air/water interface curvature is controlled by air pressure. Determinations made with the pressure-plate apparatus agree with those made by the suction method. Examples are given of the effect of various soil-sample treatments on moisture retention, and the use of the apparatus for studying hysteresis and moisture movement in unsaturated soil is illustrated. C. J. G.

532.691 : 541.183.2 *see Abstr.* 2301

532.694.1 2131

Inhibition of foaming in solvents containing known foamers. ROSS, S., AND MCBAIN, J. W. *Industr. Engng Chem.*, 36, *pp.* 570–573, *June*, 1944.—Ethyl ether and amyl alcohol operate only when directly applied to foam and are usually inactive when dissolved in the liquid. All the additives here studied were dissolved in the liquids, and some were highly effective anti-foamers. A number of additives were tested as chemical defoaming agents for 5 systems, aq. and non-aq., containing known added foamers. Systems which have a chemical similarity in either solute or solvent, when compared with resp. to the anti-foaming effect of the same additives, show a corresponding effect in 3 out of every 4 cases. Complete correspondence is shown between Aerosol OT in triethanolamine and Aerosol OT in diethylene glycol. In some cases excess of an insoluble anti-foam nullifies its effect. Results of bulk foaming tests bear a large degree of correspondence with the action of an additive on a single film.

532.695.1 : 541.182.4 2132

Studies in peat. 12. Mona wax (Irish peat wax) and emulsification. AHERNE, J. C., AND REILLY, J. *Sci. Proc. Roy. Dublin Soc.*, 23, *pp.* 247–256, *June*, 1944.—Mona wax acts as an emulsifying agent which sponsors the emulsification of water in hydrocarbon oil. Emulsions of water in liquid paraffin containing up to 79% of water were prepared and examined. The mechanism by which moist peat is readily extracted by petroleum-hydrocarbon solvents is accounted for in terms of the effectiveness with which the wax itself acts as an emulsifying agent. The intermittent-addition, intermittent-shaking method resulted in the satisfactory emulsification of water in the oils chosen. The existence, in the case of emulsions of water in liquid paraffin (where Mona wax was used as emulsifying agent), of plastic-like, interfacial films, surrounding the water-globules, is demonstrated. Such films have but little mechanical strength. While the emulsions were reasonably permanent, it is considered that any coefficient arrived at by the methods of size-frequency analysis (due precaution being taken against submission of the interfacial membrane to undue external mechanical disturbance) might, in the case of such systems, be termed a factor of permanence rather than a stability factor.

532.73-1 : 518.3 2133

Gas-solubility and partial-pressure nomograph for correlation of data. OTHMER, D. F., AND BENENATI, R. F. *Industr. Engng Chem.*, 36, *pp.* 375–377, *April*, 1944.

532.739.2 2134

Critical solution temperatures of paraffins with nitrobenzene and β, β′-dichloroethyl ether. WOODBURN, H. M., SMITH, K., AND TETEWSKY, H. *Industr. Engng Chem.*, 36, *pp.* 588-590, *June*, 1944.—The crit. solution temp. of 10 paraffin hydrocarbons with nitrobenzene and 6 with β,β'-dichloroethyl ether were determined. Among the normal paraffins, as the number of C atoms increases, the numerical difference between the crit. solution temp. and the aniline pt. shows a steadily increasing value for nitrobenzene solutions and a steadily decreasing value for β,β'-dichloroethyl ether solutions.

532.77 : 545.8 : 547.5 2135

Method for determining individual hydrocarbons in mixtures of hydrocarbons by measurement of freezing points. STREIFF, A. J., AND ROSSINI, F. D. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 185–196, *May*, 1944.—Experimental data are given for the determination of the four C_8 aromatic hydrocarbons. The uncertainty of the determination of each hydrocarbon is near ± 1% of the total sample. The method is based on the fact that the amount of a hydrocarbon H in an unknown mixture of hydrocarbons can be determined by measurement of the lowering of the f.p. of a sample of pure H caused by the addition to it of a given amount of the unknown mixture.

533.15 : 539.185 : 517.948.34 = 3 *see Abstr.* 2096

533.15 : 539.217.5 *see Abstr.* 2228

534.115 : 531.787.3 2136

Forced and free motion of a mass on an air spring. SUSSHOLZ, B. *J. Appl. Mech.*, 11, *A*101–*A*107, *June*, 1944.—Results are given of a theoretical investigation of the transient response of a simple non-linear mechanical system to various types of applied forces. A cylindrical tube closed at one end, with a light piston inserted in the other, was used experimentally, the non-linear elasticity of the confined column of air governing the motion of the piston. Such systems have been used in ballistic studies to measure transient pressures, as well as for the measurement of pressures caused by other types of explosions in air.

534.121.1 2137

On the vibrations of a clamped plate under tension. WEINSTEIN, A., AND CHIEN, W. Z. *Quart. Appl. Math.*, 1, 1, *pp.* 61–68, *April*, 1943.—The fundamental frequency is estimated for a square plate under uniform tension. The frequencies of such a plate cannot be given explicitly in terms of elementary functions, but the Rayleigh–Ritz method yields an upper bound. The paper shows how an increasing sequence of lower bounds can be obtained by applying a variational method. A narrow interval is thus obtained within which the frequencies are located. Numerical results are given for various tensions. L. S. G.

534.321.9 : 532.525 2138

Nozzles for supersonic flow without shock fronts. SHAPIRO, A. H. *J. Appl. Mech.*, 11, *A*93–*A*100, *June*, 1944.—Flow patterns for compressible fluids at ultrasonic velocities are discussed, and it is shown that shock fronts form when neighbouring Mach lines (envelopes of wave fronts originating from point disturbances) intersect. A criterion for divergence of Mach lines is developed for cases in which the passage

is symmetrical in 2 or 3 dimensions and has a straight axis. This criterion is used as the basis for designing ultrasonic nozzles and diffusers. Only a nozzle of infinite length can discharge a parallel stream into a tube of const. cross-section without the formation of shock fronts. Methods are presented for designing nozzles of finite length, with the intensity of shock fronts reduced to as small a value as possible, and it is shown that nozzles of reasonable length may be designed so that shock fronts are insignificant.

535.21-31 : 576.8.095.14 : 614.71 2139

Studies on air-borne virus infections. II. The killing of virus aerosols by ultra-violet radiation. EDWARD, D. G. FF., LUSH, D., AND BOURDILLON, R. B. *J. Hyg.*, 43, *pp.* 11–15, *Jan.*, 1943.—The experiments show that rapid and effective sterilization of atmospheres containing atomized particles of influenza and vaccinia viruses, and probably also of herpes simplex virus, can be obtained by ultra-violet 2 537 Å radiation. At least 99%, and probably more, of an aerosol of influenza virus was killed by exposure for 6 sec. at a distance of 2 cm. from either a Hanovia lamp or a G.E.C. Sterilamp. The Sterilamp killed more than 99% of vaccinia virus with an exposure of 1 sec. and about 90% in 0·5 sec. The expts. with herpes were less satisfactory, but suggested a similar sensitivity. C. J. G.

535.241.33 : 621.325 2140

Experiments on the candle-power and brightness of the positive crater of the electric arc, using solid carbons and graphite electrodes. MACGREGOR-MORRIS, J. T. *J. Instn Elect. Engrs*, 91, *Part I, pp.* 183–198, *May*, 1944.—[Abstr. 1688 B (1944)].

535.247.4 : 532.62 2141

Measurement of detergency. A photometer for determination of films on transparent surfaces. Determination of rate of hard-water film formation in the washing of glass objects. WILSON, J. L., AND MENDENHALL, E. E. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 251–254, *April* 20, 1944.—A simple photometer is described, for the quantitative determination of hard-water films formed on transparent glass plates during detergent processes (dishwashing). Constructional details and the electrical measuring circuit are discussed and information on the sensitivity of the instrument is given. A method is outlined for measuring the tendency of precipitates formed by the reaction between detergents and Ca and Mg salts to adhere to glass surfaces during washing.

535.338 : 518.3 *see Abstr.* 2098

535.338 : 546.841 = 3 2142

The structure of the Th II-spectrum. I. BRUIN, T. L. DE, SCHUURMANS, P., AND KLINKENBERG, P. F. A. *Z. Phys.*, 121, 11–12, *pp.* 667–678, 1943.—Experiments are described which permit new measurements of the wavelengths and the Zeeman effect in the spectrum of an ionized Th atom. An analysis of the spectrum is made and over 1 900 lines can be regarded as transitions between two systems A and B, the former having 36 odd and 94 even levels and the latter 25 even and 77 odd levels. The observed levels of system A are tabulated and a treatment is included of the $5f7s^2$—, $5f6d7s$— and $5f6d^2$— configurations of Th II. L. S. G.

535.338.4 : 546.17 2143

Singlet terms in the spectrum of molecular nitrogen. GAYDON, A. G., AND WORLEY, R. E. *Nature, Lond.*, 153, *p.* 747, *June* 17, 1944.

535.338.42 2144

The vibrational spectra of the vinyl halides. TORKINGTON, P., AND THOMPSON, H. W. *J. Chem. Soc., pp.* 303–305, *June*, 1944.—The infra-red absorption spectrum of vinyl iodide was measured between 3 μ and 20 μ. The frequencies of the absorption bands are correlated with data from the Raman spectrum, and the rotational contour of the infra-red bands is examined. Magnitudes are assigned to all 12 fundamental frequencies, and the fundamentals of vinyl chloride, bromide and iodide are compared. The variation in magnitude of a given type of mode as the mass of the halogen atom changes is discussed.

535.338.42 2145

Infra-red spectrum of allene and interactions between molecular vibration and rotation. THOMPSON, H. W., AND HARRIS, G. P. *Trans. Faraday Soc.*, 40, *pp.* 295–300, *July-Aug.*, 1944.—The spectrum of allene vapour over the range 3–20 μ was re-measured. Results confirm available information on all main features and on vibrational analysis by resolution of the rotational contours of several bands; better resolving power shows some details of the rotational structure of two perpendicular-type bands. A previously unrecorded feeble band at $\sim 13\,\mu$ is reported and discussed. N. M. B.

535.338.42 : 535.375.51 *see Abstr.* 2153

535.338.42 : 535.375.51 : 536.7 2146

The vibrational spectrum of pyridine and thermodynamic properties of pyridine vapours. KLINE, C. H., JR., AND TURKEVICH, J. *J. Chem. Phys.*, 12, *pp.* 300–309, *July*, 1944.—An analysis of the vibrations of the pyridine molecule is made on the basis of infra-red, Raman and ultra-violet absorption spectra. The fundamental frequencies are assigned and the thermodynamic properties of pyridine calculated on the basis of such an assignment.

535.338.42 : 536.7 2147

The molecular structure and thermodynamics of propane. The vibration frequencies, barrier to internal rotation, entropy and heat capacity. PITZER, K. S. *J. Chem. Phys.*, 12, *pp.* 310–314, *July*, 1944.—A complete picture is proposed for the vibrational and torsional motions of the propane molecule [Abstr. 2098 (1941)]. Comparison with the experimental entropy and heat capacity shows agreement. The free-energy, heat-content and heat-capacity functions are calculated over the range 180° to 1 500°K. By obtaining the fundamental frequency of one torsional mode from a combination band in the infra-red spectrum, it was possible to evaluate the other from the entropy. The force constants calculable therefrom indicate that the apparent increase of potential barrier from ethane to propane arises from interaction of methyl-group H atoms. For that mode in propane where these distances remain larger, the torsional force const. is the same as that for ethane.

535.34-31 : 541.621 *see Abstr.* 2305

535.343 = 3 2148

On the effect of thermal expansion on the absorption spectrum of insulators. MÖGLICH, F., AND ROMPE, R.

Z. Phys., 119, 7–8, *pp.* 472–481, 1942.—In addition to the displacement of the absorption limit of solid insulators by multiple collisions, a long-wave displacement is produced by the thermal expansion of the lattice. Evaluation of the electrons in the solid shows that the effect is ∝ the coeff. of expansion and the temperature. [Abstr. 1539 (1941)]. H. G. S.

535.343 2149

New absorption band of alkalis in the presence of foreign gases. CH'EN SHANG-YI. *Phys. Rev.*, 65, *pp.* 338–340, *June* 1 *and* 15, 1944.—In the presence of foreign gases, a narrow and structureless absorption max. was observed on the short-wavelength side of certain members of the principal series of alkali metals. A résumé of the results obtained so far is given. It is suggested that the band is due to the increase in the energy of the optical electron through the process of collision with a foreign gas atom when the electron is at that energy level whose orbital radius is close to the distance of optical collision.

535.37 : 545.721 2150

A method for determining small quantities of oxygen. POLLACK, M., PRINGSHEIM, P., AND TERWOORD, D. *J. Chem. Phys.*, 12, *pp.* 295–299, *July*, 1944.—A method is described for following the production rate of minute quantities of oxygen. The method is based on the quenching of the phosphorescence of a dye adsorbed on silica gel. Examples of the application of the method are discussed.

535.37 = 3 2151

On the mechanism of luminescence of crystalline phosphors. SCHÖN, M. *Z. Phys.*, 119, 7–8, *pp.* 463–471, 1942. [See Abstr. 1149 (1939)]. H. G. S.

535.372 2152

Fluorescence spectra of naphthacene molecules in solid solution of anthracene with the variation of wavelengths. GANGULY, S. C. *Nature, Lond.*, 153, *pp.* 652–653, *May* 27, 1944.

535.375.51 : 535.338.42 2153

Raman spectra of acetylenes. VII. Symmetrical-top acetylenes. CLEVELAND, F. F., AND MURRAY, M. J. *J. Chem. Phys.*, 12, *p.* 320, *July*, 1944.—Erratum. [See Abstr. 172 (1944)].

535.375.51 : 536.7 : 535.338.42 *see Abstr.* 2146

535.4 : 548.0 *see Abstr.* 2315

535.421 = 3 2154

On the theory of the anomalous reflection at diffraction gratings. ARTMANN, K. *Z. Phys.*, 119, 9–10, *pp.* 529–567, 1942.—A theoretical analysis of the bright bands [Abstr. 622 (1936)] caused by anomalous concentration of the intensity of the ray at approx. grazing emergence from the grating. An explanation is given to account for these anomalies occurring only when the incident light is polarized so that the vector of the magnetic field is parallel to the grating grooves. Formulae are derived which give values of the intensity distribution in the neighbourhood of these bands, in agreement with experimental data. H. G. S.

535.43 : 576.72 2155

Problems of the transmission of light through tissues and some other media. EVANS, D. S. *Phil. Mag.*, 56, *pp.* 300–314, *May*, 1944.—The absorption and scattering of light in media of two constituents, in which the second constituent is distributed throughout the first in the form of a series of vessels having some common geometrical characteristic, is considered. The application of the results to the transmission of light through living tissues is discussed; on certain plausible assumptions, the absorption of light in a layer of blood-bearing tissues depends only on the total volume of blood present and not on the manner of its distribution as between larger and smaller vessels. The influence of scattered light is considered, and it is shown that its proportionate effect in the total energy transmitted is reduced when the dia. of the beam is diminished.

535.434 : 541.182.5 *see Abstr.* 2297

535.51.06 : 518.5 : 681.14 2156

— **Polarized-light servo system.** BERRY, T. M. *Trans. Amer. Inst. Elect. Engrs*, 63, *pp.* 195–198, *April*, 1944.—Describes a system, developed for electromechanical calculating machines, in which a secondary shaft follows exactly the rotation of a primary shaft without applying any torque to the latter. The primary shaft carries a disc of polarizing material through which two beams of light pass from the same source. The beams pass through two crossed polarizers, mounted on the secondary shaft, and illuminate two photocells. When the primary polarizer is at 45° to both secondary polarizers, the cells are equally illuminated; for other angles the illumination is unequal. The cells control the speed and direction of a split-field motor (which drives the secondary shaft); d.c. amplifiers and thyratrons are used for this control. Damping is provided by a generator, driven from the secondary shaft, which applies bias to the d.c. amplifiers through a *C–R* differentiator. Applications to integration, speed measurement and differentiation are described; the G.E.C. differential analyser has 14 integrating units using this servo system. C. F. B.

535.551 : 679.56 : 539.38 *see Abstr.* 2241

535.566.2 2157

Optical rotation of Pennsylvania lubricants. CARNAHAN, F. L., HERSH, R. E., AND FENSKE, M. R. *Industr. Engng Chem.*, 36, *pp.* 333–335, *April*, 1944.—Optical rotations were found on distillate fractions from 76 commercially refined Pennsylvania oils and in most cases a reading was made on the original oil. The highest rotation noted for any fraction was + 0·26. Higher values obtained in an equivalent procedure indicate a crude source other than Pennsylvania.

535.7 : 612.84 = 3 2158

New measurements on the sensitivity of vision. SIEDENTOPF H., MEYER, E. J., AND WEMPE, J. *Z. InstrumKde.*, 61, *pp.* 372–380, *Nov.*, 1941:—Measurements of visual acuity and visibility thresholds are presented in relation to background brightness-level and contrast level between background and test object. The visual acuity tests were made with Landolt rings and the visibility tests with a small circular dark spot. An objective recording method was used, in which, instead of the threshold of recognition being directly stated by the subject-observer, replies to a std. answer afford a behaviouristic definition of the threshold value, capable of being checked by the operator. The results obtained by this method

are capable of reproduction at will, and represent the values obtained on a trained observer with a margin of error of about ± 5%. Comparison with earlier data on visual acuity indicates the necessity of adopting some standard definition for the "recognition threshold" of the viewed object. C. J. G.

535.733.1 2159

Incidence of colour-vision weakness. GRAY, R. C. *Nature*, 153, *p.* 657, *May* 27, 1944.

535.755 2160

The Ishihara test for colour blindness. PICKFORD, R. W. *Nature, Lond.*, 153, *pp.* 656–657, *May* 27, 1944.

535.826.7 : 535.88 2161

Projection arrangement for determination of fibre dimensions. GRAFF, J. H., AND FEAVEL, J. R. *Paper Tr. J.*, 118, *TAPPI Sect.*, *pp.* 53–57, 1944.—The pulp is stained in the Kantrowitz and Simmons modification of Bright's stain and washed, and 1 drop of an aq. suspension is dried on a microscope slide at approx. 50° and wetted with aq. $CaCl_2(d = 1{\cdot}36$ at 28°). The individual fibres can then be teased out straight and parallel and projected on to a ground-glass screen (× 75) on which the lengths and widths are measured to within 0·1 and 0·01 mm., respectively. Improved accuracy and rapidity of working are claimed for the method. The results are subjected to statistical analysis. Since the density of fibres from the same source is approx. const., it is possible to calculate the approx. wt. from the measured area. J. G.

535.87 2162

A fine mechanical adjustment of variable sensitivity. PERFECT, D. S. *J. Sci. Instrum.*, 21, *pp.* 123–124, *July*, 1944.—It was desired to adjust to a specific setting the tilt of a mirror to an accuracy of the order of 0·1 in. or better. A spring was encastered at one end and also constrained on one side near this end by an adjustable fixed ball. Near this ball a second ball presses against the other side of the spring, and is given minute displacement when the spring is flexed by a screw controlling the free end. The displacement can be used to give linear or angular adjustment to a suitably constrained body linked to the second ball. Adjustment of the longitudinal separation of the two balls controls the minification factor.

535.88 : 535.826.7 *see Abstr.* 2161

536.212 2163

Variable heat flow in steel. JACKSON, R., SARJANT, R. J., WAGSTAFF, J. B., EYRES, N. R., HARTREE, D. R., AND INGHAM, J. *J. Iron Steel Inst.*, [57 *pp.*], *July*, 1944. *Advance copy.*—Methods for the calculation of variable heat flow were devised which take into account the variable diffusivity of the material, lat. ht. of a change point, and surface conditions. Calculations made for the case of a steel ingot cooling in a mould allowed for the radiative heat transfer across the air gap between ingot and mould and the different thermal properties of the two materials. A rapid approx. method of obtaining the central temperature of an ingot was devised. A nomograph and slide rule are given for calculating the soaking time required for uniformity of temperature in industrial practice.

536.212.3 : 677 2164

Thermal properties of moist fabrics. HOCK, C. W., SOOKNE, A. M., AND HARRIS, M. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 229–252, *May*, 1944.—The chilling effect that moist fabrics produce when in contact with the body was evaluated by subjective tests, by measurement of the drop in temperature that ensued when the moist fabrics were placed on an artificial skin surface, and by tests with a moisture-sensitive paper designed to measure the extent of contact which the fabrics made with a surface. Using fabrics of various fibre compositions and constructions, a good qualitative relation was found in these tests. Fabrics which produced considerable chilling in subjective tests were found to make good contact and to cause a substantial drop in skin temperature. Conversely, fabrics which caused little or no clamminess made poor contact and the accompanying drop in temperature was small.

536.242 2165

Heat transfer coefficients in agitated vessels. CHILTON, T. H., DREW, T. B., AND JEBENS, R. H. *Industr. Engng Chem.*, 36, *pp.* 510–516, *June*, 1944.—An extension of the method for correlating forced-convection heat-transfer data is proposed for a coil and the inside surface of a vessel with the fluid agitated by a flat paddle. The correlation is suitable for the turbulent region of agitation, up to the point where gas is drawn into the liquid. Water, two oils and glycerol were used, and the temp. diff. across the heat-transfer surface was varied over a wide range.

536.243 2166

Heat transfer in the Votator. HOULTON, H. G. *Industr. Engng Chem.*, 86, *pp.* 522–526, *June*, 1944.—High agitation combined with scraping of the heat-transfer wall produces thin films and high turbulence. The result is high rates of heat transfer even though the linear velocity through the Votator is $<0{\cdot}1$ ft./sec.

536.413 : 679.5 2167

Thermal expansion and second-order transition effects in high polymers. I. BOYER, R. F., AND SPENCER, R. S. *J. Appl. Phys.*, 15, *pp.* 398–405, *April*, 1944.—High polymers have an expansivity approx. that of liquids, and exhibit a discontinuity in thermal expansion at the second-order transition point, T_m, at which temperature there is also a change in other physical properties. Below T_m, a high polymer has dimensional stability and brittleness; above T_m, rubber-like properties appear. The paper gives determinations of T_m, of the cub. exp. coeff. β_1, below, and β_2, above T_m, and $\Delta\beta = \beta_2 - \beta_1$. Experimental procedure for several new materials, notably saran, is dealt with. The thermal expansion of the incompatibles polystyrene plus polyolefins has also been studied. G. E. A.

536.413.2 : 669.13 2168

Thermal expansion of high-silicon cast iron. HIDNERT, P., AND DICKSON, G. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 145–150, *April*, 1944.—Data are given on high-Si cast iron containing approx. 14% of Si with 3% of Mo and without appreciable Mo, at various temperatures between 20°–700°C. Differences between the coefficients of expansion were slight. Both high-Si cast irons have slightly higher coefficients of expansion than electrolytic iron between 20°–

300°C., and appreciably higher coefficients for higher temperature ranges. No indication of growth similar to that of ordinary cast iron was observed on heating the high-Si cast iron to 700°C.

536.421 : 547.5 2169

Theoretical analysis of certain time/temperature freezing and melting curves as applied to hydrocarbons. TAYLOR, W. J., AND ROSSINI, F. D. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 197–214, *May*, 1944.—A method is described for determining analytically or graphically, from appropriate time/temperature freezing and melting curves obtained on hydrocarbons, the f.p. of a given substance, and within certain wide limits, the f.p. of that substance for zero impurity (liquid-soluble, solid-insoluble).

536.423.15 : 541.123.1.012 : 518.3 2170

Correlating vapour pressure and equilibrium-constant data. OTHMER, D. F. *Industr. Engng Chem.*, 36, *pp.* 669–672, *July*, 1944.—Data for equilibrium const. *K*, used in distillation and gas absorption design calculations, are correlated by a log. plot against v.p. of a reference substance at the same temperatures to give substantially straight lines. A nomogram is prepared based on this correlation which gives *K*-values for the hydrocarbons below nonane at different pressures and temperatures in a form which is useful when const. *K*-values are to be compared. A second nomogram is also presented which is useful for obtaining *K*-values for hydrocarbons in this range at the same temperature and pressure as would be necessary in plate-to-plate calculations of a distilling column handling hydrocarbons.

536.46 : 536.662 2171

Unreleased energy in flame gases. DAVID, W. T., AND MANN, J. *Nature, Lond.*, 154, p. 115, *July* 22, 1944.—[See Abstr. 394 (1944)].

536.468 2172

Flammability limits in air. WILLSON, K. S., AND WALKER, W. O. *Industr. Engng Chem.*, 36, *pp.* 466–468, *May*, 1944.—For methyl-chloride–air mixtures, 7·6% by vol. methyl chloride is the lowest flammable limit; 19·1% methyl chloride by vol. is < the upper lim. value of 19·7% previously reported. Mixtures of methyl chloride and air are nonflammable if they contain 10% by vol. or more of dichlorodifluoromethane. Mixtures containing 56·5% by vol. (35·0% by wt.) or less of methyl chloride in dichlorodifluoromethane are nonflammable when mixed with air in any quantity. A spark operating from a 15 000 V transformer is the most dependable source of ignition.

536.532 : 621.317.39 2173

High-speed multiple-point potentiometer recorder for measuring thermocouple temperatures during test-plane flights. STEIN, I. M., WILLIAMS, A. J., JR., AND CLARK, W. R. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 271–275, *May*, 1944.—[Abstr. 1676 B (1944)].

536.587 : 621.316.74 2174

A wide-range sensitive thermoregulator. COATES, G. E. *J. Sci. Instrum.*, 21, *pp.* 86–87, *May*, 1944.—[Abstr. 1663 B (1944)].

536.631 : 546.831 2175

Specific heat of zirconium dioxide at low temperatures. KELLEY, K. K. *Industr. Engng Chem.*, 36, *p.* 377, *April*, 1944.—The sp. ht. of crystalline ZrO_2 was measured from 52° to 298°K., and the entropy was computed as $S°_{298\cdot16} = 12\cdot03 \pm 0\cdot08$. The entropy and free energy of formation from the elements are, respectively, $\Delta S°_{298\cdot16} = -46\cdot5$ and $\Delta F°_{298\cdot16} = -244\,200$.

536.633 : 536.8 : 518.3 2176

Hydrocarbon gases. Specific heats and power requirements for compression. SCHEIBEL, E. G., AND OTHMER, D. F. *Industr. Engng Chem.*, 36, *pp.* 580–583, *June*, 1944.—Nomographs and methods of calculation are given for determining the ratio of the sp. heats of hydrocarbon gases, the final temperatures attained in a compression or expansion, and the theoretical h.p. requirements for compression.

536.662 : 536.46 *see Abstr.* 2171

536.666 2177

Thermodynamics of Friedel–Crafts reactions. CAMPBELL, H., AND ELEY, D. D. *Nature, Lond.*, 154, *p.* 85, *July* 15, 1944.

536.7 : 532.01 *see Abstr.* 2121

536.7 : 535.338.42 *see Abstr.* 2147

536.7 : 535.375.51 : 535.338.42 *see Abstr.* 2146

536.7 : 539.132 2178

The thermodynamic properties and potential energy of solid argon. RICE, O. K. *J. Chem. Phys.*, 12, *pp.* 289–295, *July*, 1944.—An attempt [Abstr. 626 (1941)] was made to obtain the interatomic potential for a pair of A atoms, using the sp. ht. data at low temp. and a theory in which the Debye characteristic temperature Θ was related to the curvature of the interatomic potential energy curve. Difficulties in accounting for experimental data were explained on the supposition that disorder sets in in the solid below the m.p. A new calculation is given in which the Debye theory is assumed to hold throughout, and Θ and the potential energy of the solid are calculated independently of each other from the available experimental data. A consistent picture of the thermodynamic properties of solid A is thus obtained, but the interatomic potential curve for a pair of atoms differs greatly from that obtained by the method used previously. The interatomic potential curve found here shows extreme change in curvature near the min.

536.7 : 620.19.01 2179

Thermodynamic considerations in the corrosion of metals. WARNER, J. C. *Trans. Electrochem. Soc.*, 83, *pp.* 319–333, 1943.—[Abstr. 1609 B (1944)].

536.7 : 669.71 2180

Correspondence on S. T. Konobeevski's paper: "A thermodynamical theory of restoration phenomena in the ageing of aluminium-copper alloys." *J. Inst. Met.*, 70; *pp.* 291–296, *June*, 1944.—[See Abstr. 2589 B (1943)].

536.717 2181

Mollier diagrams for theoretical alcohol-air and octane-water-air mixtures. WIEBE, R. *Industr. Engng Chem.*, 36, *p.* 672, *July*, 1944.—Correction. [See Abstr. 2603 (1942)].

536.77 : 546.391.31 2182

The dissociation of ammonium chloride. STEPHENSON, C. C. *J. Chem. Phys.*, 12, *pp.* 318–319, *July*, 1944.—Two values for the standard free energy of

dissociation of NH_4Cl into NH_3 and HCl, calculated by 2 independent paths, are 21 860 cal. and 21 780 cal. at 298·1°K. The agreement serves as additional evidence for the complete dissociation of NH_4Cl in the vapour phase. The corresponding values calculated for ΔH at 298·1° are 42 160 and 42 260 cal. Two independent values for the std. entropy of the aqueous NH_3 ion at 298·1°K. derived from these data are 26·5 and 27·1 cal. mole^{-1} deg.$^{-1}$.

536.8 : 518.3 : 536.633 *see Abstr.* 2176

537.226.2 : 541.132 *see Abstr.* 2281

537.29 = 3 2183

On periodic space distribution of freely moving ions and electrons. SCHUMANN, W. O. *Z. Phys.*, 121, 11–12, *pp.* 629–646, 1943.—A comprehensive study is made of the periodic states that may exist in the space between anode and cathode, when the latter are plane. Let the ionic and electronic velocities at the anode be U_a and V_a (in eV) and let the voltage and field strength at a distance x from the anode be $U(x)$ and $E(x)$. Then $(dU/dx)^2 = E^2 = E_a^2 + a\{(U_a+U)^{1/2} - U_a^{1/2}\} - b\{V_a^{1/2} - (V_a-U)^{1/2}\}$, where E_a is the field at the anode and a and b are $\propto$, respectively, i_p and i_n, the pos. and neg. current densities. The max. and min. values U_m of U are found and the conditions for a periodic state are shown to be either

$$(U_a/V_a)^{1/2} < a/b < V_a^{1/2}/\{(U_a+V_a)^{1/2} - U_a^{1/2}\}$$

or $(U_a/V_a)^{1/2} > a/b > \{(U_a+V_a)^{1/2} - V_a^{1/2}\}/U_a^{1/2}$

so that such a state is possible only for limited current ranges. The question of stability is discussed and, in the case of small oscillations of U with resp. to x, the above equation is integrated approx. to give $U = L + M\sin(Px+Q)$ where L, M, P, Q are functions of the parameters of the system, the space wavelength being $\Lambda = 2\pi/P$. In this case the theory is extended further than in the general case, and an example is given relating to Hg^+ ions. For such an ion, $a \approx 4 \cdot 10^8 i_p$ and, since $b = \frac{2}{3} \cdot 10^6 i_n$, it is found that $\Lambda \approx 0{\cdot}02\, V_a^{3/4}/i_n^{1/2}$ cm., when the ion velocity U_a is negligible compared with V_a. L. S. G.

537.29.047 : 578.087.87 2184

The measuring of bio-electric potentials. BURR, H. S. *Yale J. Biol. Med.*, 16, *pp.* 353–360, *March*, 1944.—It is deduced that the recorded p.d.'s are measures of a store of electrical energy which can be drawn upon by biological activity, and which provide valuable evidence of the nature and range of that activity. The pattern of the p.d.'s defines an electrodynamic field whose forces critically influence growth and development and determine the pattern of living things. This design is the most important problem in biology; on it depends taxonomy and systematics; and it is the expression of those forces which impart stability in the midst of chemical flux. C. J. G.

537.311.2(091.2) 2185

The reception of Ohm's electrical researches by his contemporaries. WINTER, H. J. J. *Phil. Mag.*, 35, *pp.* 371–386, *June*, 1944.

537.312 2186

Anomalous behaviour of the electrical resistivity of some iron-cobalt alloys. SIEGEL, S., AND MCGREARY, R. *Bull. Amer. Phys. Soc.*, *April* 28, 1944.—The equilibrium resistivity of alloys containing 42% Co, and 30 or 42% Co + 2% V, was measured over the range 20°–1 100°C. The resistance rises monotonically up to about 950°C., the phase-change temperature, where a discontinuous increase occurs. Above this temperature, the resistivity again increases, with a smaller const. temp. coeff. No evidence for an ordered structure was found. A series of experiments attempting to relate the room-temperature resistivity to thermal history showed that the cold-rolled alloy has a lower resistivity than the presumable equilibrium value of the alloy slowly cooled from high temperatures: the alloy quenched from above the point has higher resistivity than the cold-worked alloy, but still lower than the annealed material. Cold work following quenching reduces the resistivity again; repeated quenching and annealing result in cyclic decrease and increase in resistivity. These effects are only present in alloys containing V.

537.312.62 : 538.224 = 3 2187

The absolute diamagnetism of supraconductors. NEUGEBAUER, T. *Z. Phys.*, 119, 9–10, *pp.* 581–589, 1942.—Simple layers at the boundary surfaces of the supraconductor accord with the theory derived from the formulae of normal diamagnetism, whereas on the London theory the layers are double magnetic. According to the first theory, the magnetic field intensity in the interior would increase, according to the second it would disappear. H. G. S.

537.362 : 581.037 2188

Electrodialysis of seeds. NELLY, J. D. *Plant Physiol.*, 19, *pp.* 19–32, *Jan.*, 1944.—Experiments to determine the effects of electrolysis on a living organism, using pea- and kidney-bean seeds, are described and results discussed. Germination was markedly decreased. A Mattson electrodialysis cell with parchment paper membranes, a Cu grid cathode and a C anode, were used. 80–150 V d.c. was supplied by either a rectifier or d.c. mains. The rectifier was equipped with a rheostat for regulating voltage, the voltage from the d.c. line being controlled by a potentiometer. The temperature of the cell was controlled by running water through glass coils placed in the end chambers; this system kept the temperature of the cell near 24°C. C. J. G.

537.363 2189

Cataphoretic velocities of pure copper ferrocyanide sol. CHAUDHURY, S. G., AND BHATTACHARYA, K. L. *Nature, Lond.*, 153, *p.* 713, *June* 10, 1944.

537.523.5 = 3 2190

Systematic formulation of arc types. WEIGEL, W. *Z. techn. Phys.*, 24, 4, *pp.* 90–92, 1943.—Six equations are given which apply to the plasma of any form of gas discharge. Arc conditions may be considered as being (1) that the plasma is quasi-neutral, and (2) that the carrier concentration is in equilibrium with the temperature. A discussion of the boundary conditions tends to the formation of 3 types of arc discharge. E. R. A.

537.525 2191

Theory of cathode sputtering in low-voltage gaseous discharges. TOWNES, C. H. *Phys. Rev.*, 65, *pp.* 319–327, *June* 1 *and* 15, 1944.—To determine the amount of sputtering in a glow discharge, 3 functions must be known: the number of ions of a given energy striking

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Oxidation products and isomeric ethers of a nitrogen [illegible]

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On the products of the oxidation of mercaptans in [illegible]

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Theory of contact-electrometers or silicon electric [illegible]

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The use of magnetometers in coal mines. [illegible]

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Experimental study of the electromagnetic [illegible]

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Action of heat waves on the Hertzian [illegible]

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An investigation of the relations between [illegible]

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air is reduced to a min. It was found that the liberation of gas does not take place in the regular and consistent way which would be expected, if its production was due to a genuine effect of the magnetic field. The present data in conjunction with experimental results [Abstr. 1138 (1944)] cast considerable doubt on the existence of a "magnetrolytic" effect, and any oxygen evolved is ascribed to the liberation of air dissolved in the acidulated water. H. H. HO.

538.691 = 3 2213

The influence of space charge upon the image-formation properties of magnetic sector fields. WALCHER, W. *Z. Phys.*, 121, 11–12, *pp.* 719–728, 1943.—In a field-free space, a Cartesian co-ordinate system (x, y, z) is taken and a stream of charged particles moves parallel to the x-y plane towards a line focus parallel to the z-axis and cutting the x-axis at the point $x = f$. The stream is of rectangular cross-section and initial apertures $y = b$, $z = c$, where $c >> b$. The electron paths are parabolic, and it is found that the particles come to a line focus cutting the x-axis at the point $x = \{1 - (1 - 2Kf^2)^{1/2}\}/Kf$ if $2Kf^2 < 1$, and that, if $2Kf^2 > 1$, the beam has a min. rel. cross-section $1 - \frac{1}{2}Kf^2$, where K is the space-charge const. Next a constant magnetic field is considered in the space between 2 planes A and B cutting along a line L at an angle Φ. A beam is projected from the plane A at distance a from L towards a line focus F parallel to L and distant f from A. The particles come to a focus on the plane B if $f = (a \sin \Phi)/\{Ka^2 + (1 - Ka^2) \cos \Phi\}$. Thus in a magnetic sector field it is always possible to focus a beam, however great the space-charge effect. The value of these results in the design of a mass spectrograph for isotope separation is pointed out, and an extension of the theory to electromagnetic sector fields is briefly discussed. L. S. G.

539.11 : 548.0 *see Abstr.* 2317

539.13 2214

A molecule-building principle. HOWELL, H. G. *Nature, Lond.*, 154, *p.* 116, *July* 22, 1944.

539.13 2215

The construction of molecular models. WOOSTER, W. A. *J. Sci. Instrum.*, 21, *p.* 125, *July*, 1944.

539.132 : 536.7 *see Abstr.* 2178

539.133 : 541.265 : 541.6 *see Abstr.* 2304

539.15 = 3 2216

Drop model of the atomic nucleus. HUBER, P. *Schweiz. Arch. angew. Wiss. Techn.*, 10, *pp.* 97–102, *April*, 1944.—A review, dealing with the development of theories of the nature of the atomic nucleus, and of nuclear disintegration. The explanation of nuclear stability and instability on the drop model of the nucleus is given, and its limitations are mentioned. A. J. M.

539.152.2 = 3 2217

On the quadripole moment of the atomic nucleus $^{181}_{73}$Ta. SCHMIDT, T. *Z. Phys.*, 121, 1–2, *pp.* 63–72, 1943.—The hyperfine structure of the terms $5d^36s^2$, $^4F_{3/2,\ 5/2,\ 9/2}$ and $^4P_{3/2}$ of the Ta-I spectrum is studied by means of a Fabry–Perot interferometer, and the coupling constants are found. The mathematical method for calculating the quadrupole moment (involving the use of matrices) is presented and the value of the moment is found to be $6 \cdot 10^{-24}$. L. S. G.

539.154 = 3 2218

Probable error and limits of error applied to the problem of the atomic constants. STILLE, U. *Z. Phys.*, 120, 11–12, *pp.* 703–719, 1943.—A lengthy discussion of the difficulties arising from the use of different conversion factors in changing from one set of units to another, and of the bearing of this on the determination of the atomic constants. The quantitative difference between probable error and limiting error is discussed, and it is emphasized that authors should report quantities actually measured. There is a criticism of the use of formal (mathematical) calculations to obtain best values. [See Abstr. 1846 B (1944)]. L. S. G.

539.155.2 2219

Table of isotopes. SEABORG, G. T. *Rev. Mod. Phys.*, 16, *pp.* 1–33, *Jan.*, 1944.—The table presents a complete list of all the artificial and natural radioactive isotopes and stable isotopes known to date (covering publications received prior to June 1, 1944) together with a number of important features associated with them.

539.16 : 539.62.08 *see Abstr.* 2262

539.16.08 2220

A new type of counter for ionizing particles. MCCUSKER, C. B. A. *J. Sci. Instrum.*, 21, *pp.* 120–122, *July*, 1944.—G.-M. counters suffer from 2 disadvantages: (*a*) the thickness of the walls limits the radiation which may be studied to that above a certain min. energy, and (*b*) their shape and the thickness of the walls prevent complete cover being obtained in anti-coincidence work. A new type of counter is described in which these difficulties are overcome. Preliminary tests give a min. value of 89% for the efficiency, and absorption experiments show that 85% of the particles counted have an energy $< 1 \cdot 5 \times 10^6$ eV.

539.163 : 546.791 : 539.185 = 3 *see Abstr.* 2224

539.172 : 546.821 2221

Transmutation of titanium. HIBDON, C. T., POOL, M. L., AND KURBATOV, J. D. *Bull. Amer. Phys. Soc.*, *April* 28, 1944.—A study of the 16-day period of V^{48} produced by activation of Ti with deuterons has led to a re-evaluation of the energies of the positrons and γ-rays. The positron upper limit is 0·58 eMV. Pb absorption measurements indicate a γ-ray of 1·50 eMV. The probability of V^{48} decaying by K-electron capture to that of positron emission is approx. 18 to 1. The Sc fraction from Ti bombarded with deuterons indicates that the (d, α) reaction is unusually strong. The isomers of Sc^{44} and the isotopes Sc^{46}, Sc^{47}, and Sc^{48} were produced. The yield of the 85-day period of Sc^{46} from the Ti^{49} (d, α) reaction is greater than from the Sc^{45} (d, p) reaction. Two new reactions, Ti^{49} (d, α) and Ti^{51} (d, α) are established.

539.172.4 2222

Nuclear energy levels. CHAMPION, F. C. *Nature, Lond.*, 153, *pp.* 720–722, *June* 10, 1944.—A summary of a paper by P. Comparat entitled "Disintegration of nitrogen by fast neutrons; distribution of energy

evels of N^{15}" (*Lyons*, 1942). The resonance levels of N^{15} are investigated using the reversible nuclear reaction $^{14}N + {}^{1}n \rightarrow {}^{15}N \rightarrow {}^{11}B + {}^{4}He$. The apparatus consisted of a proportional counter connected to a linear amplifier and an oscillograph to record the total energy of disintegration of the α-particle together with that of the recoiling ^{11}B nucleus. Curves of N against E, where N is the number of peaks corresponding to total energy of disintegration products E, were drawn. There are 32 peaks corresponding to 32 energy levels of ^{15}N. A. J. M.

539.181 2223

Deflection of a beam of caesium atoms by gravity. Estermann, I., Simpson, C., and Stern, O. *Bull. Amer. Phys. Soc.*, *April* 28, 1944.—In the course of experiments for the exact measurement of the Bohr magneton, it was found necessary to determine the actual velocity distribution in a beam of Cs atoms 2 m. long with cross-section 2 mm. by 0·02 mm. The velocity distribution was measured by gravity deflection. Deviations from the Maxwell distribution in the range of low velocities occur at much lower oven pressures than expected. The slow atoms remain longer in the neighbourhood of the oven slit and have therefore a higher probability to be deflected from the beam of collisions. The results agree with an approx. calculation of this effect.

539.185 : 533.15 : 517.948.34 = 3 *see Abstr.* 2096

539.185 : 539.163 : 546.791 = 3 2224

The energy limit of the neutrons produced by the fission of uranium. Bothe, W., and Gentner, W. *Z. Phys.*, 119, 9–10, *pp.* 568–574, 1942.—The range of the energy limit determined by a photographic method and using the $N^{14}(n, \alpha)B^{11}$ reaction is slightly in excess of 10 eMV. The experimental procedure is described. H. G. S.

539.2 : 679.5 : 539.388.8 *see Abstr.* 2243

539.213.1 : 539.4.011.25 2225

Mechanism of brittle rupture. Murgatroyd, J. B. *Nature, Lond.*, 154, *pp.* 51–52, *July* 8, 1944.—The hypothesis is advanced that glass consists of an elastic matrix which contains small pockets of quasi-viscous material. These pockets take the place of Griffith's flaws; and when the glass is subjected to a stress, the initial load carried by the viscous material is conveyed to the matrix as relaxation of the stress occurs in the viscous material. In this manner a stress concentration grows with time in the matrix surrounding a viscous pocket. Finally, such a pocket would become the equivalent of a hole in the matrix when the viscous material carried no stress.

539.214 2226

A new extrusion plastometer. Schultz, H. A., and Bryant, R. C. *J. Appl. Phys.*, 15, *pp.* 360–363, *April*, 1944.—An instrument is designated to determine whether a given batch of synthetic rubber tread stock can be forced through a plate die to form a satisfactory tyre tread. G. E. A.

539.216.1 : 539.26 *see Abstr.* 2234

539.216.1 : 677.31 : 539.388.8 = 3 *see Abstr.* 2244

539.217 : 591.465.14 2227

Fluctuations in the porosity of egg-shells. Black, D. J. G., and Tyler, C. *Nature, Lond.*, 153, *pp.* 682–683, *June* 3, 1944.

539.217.5 : 533.15 2228

Permeation of hydrocarbon gases through rubber tubing. Stross, M. J., Riley, J. L., and Eby, H. M. *J. Inst. Petrol.*, 30, *pp.* 153–167, *June*, 1944.—Apparatus and procedure are described in detail. Samples of every type of natural and synthetic rubber tubing were used, and the gases for the tests were analysed by fractionation on Podbielniak fractionating equipment and by chemical absorption. The recommendations are: (1) In any plant operation where it is desired to avoid gas loss or change of composition, the use of rubber tubing should be avoided, and the contact of rubber parts with the gas be prevented. (2) Cu causes rapid deterioration of rubber by removal of S. (3) The most impermeable flexible tubing tested was Resistoflex. For short lengths of flexible tubing in gas-tight lines, the synthetic rubbers Koroseal and Neoprene have low permeabilities and are superior to rubber in resistance to ageing. For a given wall thickness, tubing of small dia. will cause lower gas losses than tubing of larger dia., and for given inside dia., heavy-walled tubing causes lower loss than thin-walled tubing. H. H. Ho.

539.217.5.08 : 676 2229

Instrumentation studies. XLIX. Penetration of paper by water vapour. III. Techniques for measuring water vapour transfer. IV. Process for creasing paper for water vapour permeability tests. *Paper Trade J.*, 118, *TAPPI Sect.*, *pp.* 11–19, 1944.—III. In the modification of the cup method described [Abstr. 2231 and 2230 (1944)] the conditioned specimen is used to seal a cup containing saturated aq. $NH_4H_2PO_4$ solution (equilibrium humidity, 92%). The cup is stored at 100°F. and 23% R.H. and weighed at intervals, and the wt. loss plotted against the time. The slope of the linear portion of the curve is a measure of the water-vapour permeability. A conditioning cabinet and an electrical controlling hygrometer, to be used in conjunction with an a.c. Wheatstone bridge, are described. IV. A reproducible creasing effect is obtainable by placing the lightly folded, conditioned specimen under a gently applied cylindrical weight having a flat base, and exerting a force of 6 lb./in. of crease for 15 sec., the paper being supported on a metal plate. The ratios of tensile strength (creased/uncreased) for 10 bag papers were similar for creases produced as described, and by a good commercial bag-making operation. J. G.

539.217.5.08 : 676 2230

Comparison of methods for the determination of water vapour permeability. Weber, C. G. *Paper Tr. J.*, 118, *TAPPI Sect.*, *pp.* 24–26, 1944.—The General Foods Cabinet cup method for wrapping papers, (1) with, and (2) without desiccation, and (3) the *TAPPI* std. method are compared for 11 varied wrapping materials. The samples fall into approx. the same order for all 3 methods, except that (3) does not distinguish between laminated products (comprising cellophane, metal foil and kraft paper), waxed glassine, and 3-ply glassine, especially at high temp. and humidity; further, (3) gives a high rating to laminated greaseproof board, whilst (1) and (2) do not. Method (2) is fairly satisfactory at high temperatures and humidities if repeated weighings are made until a net rate of gain in weight is established, and

light Al covers are used to cover the specimens during weighing (method 4). J. G.

539.217.5.08 : 676 2231

Comparison of methods for the determination of water vapour permeability. SEARS, G. R., SCHLAGENHAUF, H. A., GIVENS, J. C., AND YETT, F. R. *Paper Trade J.*, 118, *TAPPI Sect.*, *pp.* 27–28, 1944.—With the materials and methods tested by Weber [Abstr. 2230 (1944)] agreement is good between methods (1) and (4). A constant-rate modification of (1), in which the $CaCl_2$ in the cups is re-desiccated after the first weighing and returned to the cabinet, in 48 hr. cycles, until a linear wt. gain/storage-time curve is obtained, is described; the slope of the curve is a measure of the water-vapour permeability. The Institute of Paper Chemistry method gives values less than those from (1) and (4), especially with laminated products and glassine. J. G.

539.217.5.08 : 676 2232

Water vapour permeability of paper and paperboard. *Paper Tr. J.*, 118, *TAPPI Sect.*, *pp.* 37–39, 1944.—A revision of TAPPI Official Standard T 448 m–41, suitable for sheet materials up to 1 in. thick. The wt. of H_2O transmitted per unit time per unit area is measured while the specimen separates a dry atmosphere ($CaCl_2$) in a testing dish from a std. atmosphere of 50% R.H. and 73°F. on the other face. Suitable apparatus is described. The slope of the gain in wt./time curve, when this has become linear, is a measure of H_2O-vapour permeability. J. G.

539.232 : 541.127.1 *see Abstr.* 2275

539.24 : 539.377 : 669.018 2233

The effect of quenching and prolonged tempering on the structures of α-base tin–antimony–cadmium alloys. With an addendum on the experimental control of temper-hardening in these alloys. PELL-WALPOLE, W. T. *J. Inst. Met.*, 70, *pp.* 339–348, *July*, 1944.—The microstructures of 80 alloys were examined after the following treatments: (1) annealed to equilibrium at 150°C.; (2) quenched from the max. practicable annealing temp.; (3) as (2), then tempered at 150°C. for 8, 16, 32, 70, 150, 500 and 1 000 hr. Typical microstructures showing changes in structure produced by tempering are given. Changes in structure are correlated with changes in mechanical properties. Temper-hardening accompanies fine acicular precipitation of the δ phase, while stability during prolonged tempering depends on the degree to which this precipitation coalesces. Inter-granular embrittlement caused by tempering certain alloys is shown to be caused by precipitation of films of ε phase on the grain boundaries. Max. hardening and stability are developed by: (*a*) casting with a mould temperature of 100°–150°C., (*b*) soaking ingots for 8–24 hr. and rolled material for 4 hr. at the max. practicable annealing temperature, (*c*) quenching in cold water for binary alloys, in cold or boiling water for ternary alloys, and (*d*) tempering for 16–32 hr. at 150°C.

539.26 : 539.216.1 2234

X-ray studies of chain polymers. FANKUCHEN, I., AND MARK, H. *J. Appl. Phys.*, 15, *pp.* 364–370, *April*, 1944.—Discusses the small-angle scattering of high polymers, which reveals the existence of periodic or quasi-periodic heterogeneities, perpendicular or parallel to the axis, of the order of 50–300 Å. Also describes an X-ray microtechnique, involving the use of glass capillaries with dia. between 0·01 and 0·05 mm. which are employed as pinholes, permitting the examination of a single fibre. A series of microdiagrams taken along a single filament of drawn nylon shows that, in the unstretched state, the filament is unoriented, being crystalline on the outside and mesomorphous on the inside. The final drawn fibre is oriented and crystalline and is homogeneous, but in the intermediate stage the orientation at the surface of the fibre is different from that inside, the chains and chain bundles in the skin following the flow lines on the surface of the sample. J. T.

539.26 : 545.824 2235

Summarized proceedings of conference on X-ray analysis—Oxford 1944. *J. Sci. Instrum.*, 21, *pp.* 113–118, *July*, 1944.

539.26 : 678 2236

Observations on the X-ray structure of rubber and the size and shape of rubber crystallites. GEHMAN, S. D., AND FIELD, J. E. *J. Appl. Phys.*, 15, *pp.* 371–379, *April*, 1944.—The crystallite sizes in a series of vulcanized gum stocks are determined by X-rays, and evidence is found that the crystallite size distribution is heterogeneous. It is shown that a high degree of crystallinity is associated with a small crystallite size, and it is concluded that irregularities in the structure caused by combined S tend to limit the crystalline growth. It is realized, however, that lattice distortion may contribute to the width of the diffraction spots. J. T.

539.262 : 531.743 2237

A simple Weissenberg goniometer. WOOD, R. G., AND WILLIAMS, G. *J. Sci. Instrum.*, 21, *pp.* 141–142, *Aug.*, 1944.—A simple Weissenberg goniometer is described in which only essential features are incorporated. These are (1) a movement effected by a small synchronous electric motor giving the camera (radius 3 cm.) a translation of 1 mm. per 2° rotation of the crystal; (2) a low-power microscope on an adjustable mounting enabling the crystal to be centred on the usual goniometer head; (3) an X-ray aperture system on an adjustable mounting.

539.3 : 679.5 2238

Physical properties of a structural plastic material. ARMSTRONG, C. W. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 135–138, *Feb.*, 1944.—MR-1A Fiberglas laminates possess physical properties which enable this material to be used to advantage in aircraft structure. The ability to mould large contoured assemblies with substantially no pressure results in substantial savings in cost and in man-hours. Disadvantages include the anisotropic properties of fabric laminates, the length of time required to complete the curing of each part, the low values of the mod. of elasticity, the low bearing strength, and the present incompleteness of important physical data.

539.31 : 678 2239

Theory of the elasticity of rubber. JAMES, H. M., AND GUTH, E. *J. Appl. Phys.*, 15, *pp.* 294–303, *April*, 1944.—The rubber-like state of certain materials may be regarded as a distinct state of matter consisting of long flexible molecules. These materials may have properties grading off to those of liquids on the one hand, or to those of solids on the other. In vul-

canized materials, intermolecular bonds link the molecules into a coherent network and control its form, thereby differing from liquids. They are differentiated from solids by the small number of bonds and their weak control of the form. A picture is presented of the structure characteristic of the rubber-like state which enables the behaviour of the material to be treated quantitatively. G. E. A.

539.319 : 679.5 2240

Factors in moulding cellulose derivatives. BRACKEN, W. O., AND PIECH, F. E. *Industr. Engng Chem.*, 36, *pp.* 452–456, *May*, 1944.—Strain in translucent cellulose acetate injection-moulded or sheet-stock plastics appears related to plastics temperatures, pressures, mould (or chase) temperatures, rates of filling (injection), and solvent content (sheet stock). Strain patterns were photographed. High temperature and pressures produce pieces of min. strain pattern, closest mould reproduction and heaviest weight. Low rate of filling aids in forming bubble-free pieces. Side gating is more effective than corner gating in producing pieces free of strain. Solvent content in block prior to baking, baking temperature and cooling pressure, are critical factors in achieving strain-free sheet stock.

539.377 : 669.018 : 539.24 *see Abstr.* 2233

539.38 : 535.551 : 679.56 2241

Elasto-viscous and stress-optical properties of commercial polymerized methyl methacrylate as a function of temperature. ROBINSON, H. A., RUGGY, R., AND SLANTZ, E. *J. Appl. Phys.*, 15, *pp.* 343–351, *April*, 1944.—Young's modulus varies from 400 000 lb./in.^{2} at room temp. to 150 lb./in.^{2} at 150°C. The materials are relatively hard at room temp. and at 100°C. have the elastic properties of rubber. A suspended weighted fibre exhibits an instantaneous elastic stretch followed by a delayed elastic stretch, and a viscous flow is superimposed. Measurements of the internal stress by optical means give a very low value for the stress-optical coeff. (p.c. retardation/lb./in.^{2}/in. thickness). It varies rapidly with temp. and has a sharp max. at 93·3°C. when the viscosity is 10^{12} poise. G. E. A.

539.382 : 678.7 2242

Reinforcement of GR-S with zinc oxide. JONES, H. C. *Industr. Engng Chem.*, 36, *pp.* 641–648, *July*, 1944.—The reinforcing properties of ZnO in GR-S are influenced to a greater extent by the proper balance of accelerators, softeners and S than those of natural rubber compounds. Elastomers low in fatty acid develop higher stress/strain properties than the regular polymer containing approx. 6% fatty acid. A rosin soap polymer is superior to GR-S when compounded with ZnO. The combination of accelerator and S has a major influence on stress/strain properties of high-ZnO compounds. The inorganic accelerator, Mg, in conjunction with a small amount of a fugitive accelerator, has yielded satisfactory stress/strain properties. An improved formulation consists in a combination of Trimene base, Mg, and a coumarone-indene resin.

539.388.8 : 539.2 : 679.5 2243

Physical structure of phenoplasts. BARKHUFF, R. A., JR., AND CARSWELL, T. S. *Industr. Engng Chem.*, 36, *pp.* 461–466, *May*, 1944.—The rate of network formation, when cured phenolic films are swollen in acetone, is applied in an investigation of the effect of catalyst conc., reactant ratios, temperature of initial reaction and temperature of cure, on the degree of cure in the final hardened resin. The existing concepts of resin structure are reviewed. A modified concept of phenoplast structure which conforms with experimental facts is proposed.

539.388.8 : 539.216.1 : 677.31 = 3 2244

Structure and reaction capacity of wool. 12. Action of hydrochloric acid on wool keratin. ELÖD, E., NOWOTNY, H., AND ZAHN, H. *Melliand's Textilber.*, 23, *pp.* 577–581, 1942.—Considerable damage to the fibre results from the action of boiling HCl at *p*H 1·2. The greater the damage to the fibre, the less the swelling anisotropy; successive swelling and restoration to normal dimensions results in a characteristic longitudinal splitting of the fibre. J. G.

539.388.8 : 677.31 2245

The action of phenol on wool. BARR, T., AND SPEAKMAN, J. B. *J. Text. Inst., Manchr*, 35, *pp. T77–T78, July*, 1944.—Wool fabrics undergo shrinkage when immersed in conc. aq. solutions of phenol or melted phenol. Shrinkage is complete in 15 min. and increases with increasing temperature up to 90°C. When the treated fabric is washed in water, it tends to revert to its original area, but part ($^1/_3$) of the shrinkage persists after a 24 hr. wash. Shrinkage appears to be due to lateral swelling of fibres accompanied by length contraction. In addition, there must be some relative movement of the fibres during phenol treatment and washing. When a fabric is subjected to repeated treatment with hot phenol and water, alternately, almost the whole of the initial shrinkage can be made permanent. The primary shrinkage of the fabric in phenol can be made permanent by steaming at 102°C. for 10 min.

539.388.8 : 691.11 2246

The differential shrinkage of wood. GREENHILL, W. L. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 152–154, *Feb.*, 1944.—Gives results of shrinkage measurements made with the aid of the microscope on wood samples, consisting of thin radial sections cut entirely from rays. [See Abstr. 258 (1943)].

539.389.3 : 678 2247

Drift and relaxation of rubber. MOONEY, M., WOLSTENHOLME, W. E., AND VILLARS, D. S. *J. Appl. Phys.*, 15, *pp.* 324–337, *April*, 1944.—Rectangular blocks of rubber at 35°C. were compressed between parallel plates for 8 years. Rate of drift, at first rapid, attained a low const. value in 200 days or less. The results are expressed by an empirical equation in which the process is divided into transient and steady drifts. To reduce the time required, a method was developed to measure the relaxation in tension (decrease in stress at const. strain), a mechanical oscillator being used to find the frequency of max. resonance of lateral vibrations. The data conform to an equation of the Tobolsky–Eyring type. Steady relaxation follows an exponential decay law, and oxidation is regarded as the major cause. Total transient relaxation is increased in a vacuum and by heat. For this, a new theory is developed. G. E. A.

539.389.3 : 678 2248

Stress relaxation of natural and synthetic rubber stocks. TOBOLSKY, A. V., PRETTYMAN, I. B., AND DILLON, J. H. *J. Appl. Phys.*, 15, *pp.* 380–395, *April*, 1944.—Thin bands (rings) of synthetic and natural rubber were tested for stress decay with time, at const. elongation and temperature. Measurements were made over a range of temperatures and elongations. Complete relaxation occurred at and above 100°C. and variation of the stretch did not greatly change the rate of decay of the stress. The data obtained are discussed from the theoretical side; they indicate that a definite chemical reaction is involved in the deterioration of the rubber for which the decay of stress acts as a physical index. G. E. A.

539.389.3 : 678 2249

GR-S vulcanizates. NEAL, A. M., AND OTTENHOFF, P. *Industr. Engng Chem.*, 36, *pp.* 352–356, *April*, 1944.—Data are given on the effect of various types of accelerated ageing on a simple GR-S vulcanizate as well as a typical smoked sheet vulcanizate—namely, the oxygen pressure test, air oven test, and air-pressure heat test. The effect of small amounts of Cu and Mn on the age resistance is determined by the oxygen pressure test; the catalytic effect of these metals is less severe on the oxidation of GR-S than of natural rubber. The effect is shown of simultaneously increasing the accelerator and decreasing the S. The approx. severity of the accelerated ageing tests on GR-S vulcanizates with respect to changes in tensile strength, elongation at break and modulus, is given.

539.389.4 : 678 2250

GR-S, an elastically inverted polymer. BRAENDLE, H. A., AND WIEGAND, W. B. *J. Appl. Phys.*, 15, *pp.* 304–308, *April*, 1944.—When an element of tread rubber is strained repeatedly to 400% elongation, the GR-S type develops a greater opposing stress than a natural rubber type. It also has lower hysteresis at higher elongations and relaxes less than natural rubber. Desirable qualities in this material would be: reduced hysteresis at small elongations to allow cooler running, and greater hysteresis at greater elongations to prevent premature flex cut failure.

G. E. A.

539.389.4 : 678 2251

Hysteretic and elastic properties of rubber-like materials under dynamic shear stresses. DILLON, J. H., PRETTYMAN, I. B., AND HALL, G. L. *J. Appl. Phys.*, 15, *pp.* 309–323, *April*, 1944.—A shear vibrator was developed to measure the modulus of rubber samples at frequencies of 20 to 300 c./s., shear strains of 0·05 to 0·35, and temperatures of − 20°C. to + 120°C. Results are given for natural rubber and GR–S gum and tread stocks. The hysteresis index is nearly independent of the dynamic shear strain, but the modulus decreases with increasing strain. Both quantities are independent of the dimension ratio of the cylindrical samples, and the modulus is independent of the frequency, on which the hysteresis index is slightly dependent, for tread type stocks.

G. E. A.

539.389.4 : 679.5 2252

Hysteresis losses in high polymers. SACK, H. S., MOTZ, J., AND WORK, R. N. *J. Appl. Phys.*, 15, *pp.* 396–397, *April*, 1944.—The elastic properties of some polyvinyl chlorides were examined in the l.f. range between − 20°C. and + 80°C. where relaxation phenomena occur. A reed of the material was excited to flexural vibration by an electrostatic force and the elastic losses and the modulus could be estimated from the resonance curve. In a frequency range of 80 to 1 400 c./s., no dependence of elastic properties on frequency was observed, and it is concluded that the relaxation effects which give rise to dielectric dispersion in this region have apparently no effect on the elastic properties. G. E. A.

539.4.011.25 : 539.213.1 *see Abstr.* 2225

539.4.019 : 676 2253

Effect of humidity on physical properties of paper. CARSON, F. T. *Circ. U.S. Bur. Stand., No. C445*, [12 *pp.*], 1944.—The data, presented in 7 tables and 6 graphs, show the variation with humidity of basic ream weight, bursting strength, tearing resistance folding endurance, tensile strength and stretch.

539.413 : 678.5 2254

Low-temperature flexibility of synthetic elastomers. WILSON, G. J., CHOLLAR, R. G., AND GREEN, B. K. *Industr. Engng Chem.*, 36, *pp.* 357–361, *April*, 1944.—Some tensiometer test results are given. The effect of aviation fuels was studied.

539.42 : 676 2255

Instrumentation studies. XLVI. Tearing strength of paper. *Paper Tr. J.*, 118, 5, *pp.* 13–19, 1944.—When paper is torn, the average work required to break a fibre by tensile failure (A) is normally insignificant compared with that (B) required to pull a fibre intact from the mesh of contiguous fibres; the force involved in the latter case is, however, much less than in the former. The average tearing strength $(T) = (A + B)/2 \times$ length of line of tear. The rise in the T/beating-time curve for the early stages of beating is due to the tighter meshing of the fibres and the few failures in tensile rupture. Similarly, the addition of other agents which reduce and increase bonding strength cause an increase and decrease in T, respectively. Instruments for the measurement of T are discussed. J. G.

539.501 2256

Place-exchange theory of plastic flow, as applied to polymers. ELEY, D. D., AND PEPPER, D. C. *Nature, Lond.*, 154, *p.* 52, *July* 8, 1944.

539.501 : 532.137 : 541.182.025 *see Abstr.* 2293

539.501 : 662.66 2257

Significance of criteria of coal plasticity. LOWRY, H. H., AND JUNGE, C. O., JR. *Industr. Engng Chem.*, 36, *pp.* 308–310, *April*, 1944.—The plasticity indices obtained with plastometers are highly correlated with the proximate analyses of the coals, and the physical properties of the cokes produced can be calculated equally well from either plasticity indices or proximate analysis.

539.501 : 678 2258

Rheological properties of natural and synthetic rubbers. KELSEY, R. H., AND DILLON, J. H. *J. Appl. Phys.*, 15, *pp.* 352–359, *April*, 1944.—Description of an instrument to measure the shear stress on rubber-like materials extruded from a capillary at a given rate and temperature. The effects of variation of capillary dimensions are measured, and results are

compared with those obtained by other forms of plastometer. Differences in the behaviour of certain synthetic rubbers are discussed. G. E. A.

539.501 : 678 2259

Deformation of rubber-like materials. MOYAL, J. E. *Nature, Lond.*, 153, *pp.* 777–778, *June* 24, 1944.

539.501 : 678.9 2260

Factors influencing the plasticity and recovery of GR-S. NEAL, A. M., AND OTTENHOFF, P. *Industr. Engng Chem.*, 36, *pp.* 653–655, *July*, 1944.—The effect of milling temperature on rate of breakdown of GR-S is studied. The effect of a chemical plasticizer (RPA No. 5) on the plasticization of GR-S under the same conditions is followed. In the absence of plasticizer, temperature has only a slight effect on plasticity but a pronounced effect on recovery. Increased milling temperatures are accompanied by increase in recovery, and prolonged periods of milling are required to reduce this to its original value. In the presence of plasticizer, increasing temperature of milling tends to increase breakdown rate, and the recovery shows a steady decrease from its original value. GR-S, plasticized in the absence of a chemical plasticizer, tends to be unstable and, after short storage at room temperature, decreases in plasticity and increases in recovery. This phenomenon is more pronounced, the higher the temperature at which GR-S is milled; polymer milled at 250°F. has a recovery, after 2-week storage at room temperature, higher than the original unmilled polymer from which it was produced. Chemical plasticizers overcome this instability, and even polymers which have been broken down at high temperatures in the presence of RPA No. 5 show only a slight change in plasticity and recovery on prolonged storage at room temperature.

539.501 : 678.9 2261

Processing behaviour of high polymers. ZAPP, R. L., AND GESSLER, A. M. *Industr. Engng Chem.*, 36, *pp.* 656–661, *July*, 1944.—The effect of high-polymer deformation depends upon the rel. amount of high elastic and viscous deformation. With Butyl rubbers, the thermoplastic and thermoelastic curves detect differences in polymer behaviour which can be attributed to mol. wt. distribution as well as to average mol. wt. These factors not only affect the appearance of Butyl extruded specimens, but a ratio of elasticity to plasticity governs the swell after extrusion deformation. A narrower distribution of mol. wt. for a given average mol. wt. is desirable from a processing standpoint. Perbunan type polymers exhibit greater thermoelasticity than do Butyl or natural rubber types. Mill behaviour, the most important processing factor for Perbunan types, depends upon this thermoelasticity and its change upon mill breakdown.

539.62.08 : 539.16 2262

Measurements of the adhesion component in friction by means of radioactive indicators. SAKMANN, B. W., BURWELL, J. T., AND IRVINE, J. W., JR. *J. Appl. Phys.*, 15, *pp.* 459–473, *June*, 1944.—A radioactive method was developed which could detect 10^{-4} μg. of material transferred from an activated Cu-Be base to the body sliding on it. The spherical or hemispherical riders were slid slowly. The amount of base material adhering to the rider was proportional to the load; it increased with distance of travel and depended on surface finish and hardness of rider, and was inversely proportional to the Brinell hardness. For riders of different materials with the same hardness and surface finish, the amount of transferred metal increased with the solid solubility of the base in the material of the rider. The influence of lubrication in decreasing the transfer was greater for smaller loads. G. E. A.

539.621 2263

Mechanism of the flow of paper stock in pipes. GRAY, J. L., AND AKKER, J. A. VAN DEN. *Paper Tr. J.*, 118, *TAPPI Sect.*, *pp.* 145–150, 1944.—Surface friction (F) at a stock/metal interface is estimated by measuring the torque (T) on a cylinder of the metal rotating in the stock at known consistency (C). Data are presented. The T/rotational-speed (S) curves show a break after the cylinder has rotated at a given speed for sufficient time for equilibrium to be at that value of S. The type of motion occurring when C exceeds 2% and at speeds $<$ the critical value corresponding with the break ("plug flow") always occurs; in the other type of flow either "instantaneous plug flow" or "equilibrium flow" (which is characterized by a much lower F and a visually different type of motion) takes place. Above a critical C and S, freshly mixed stock undergoes plug flow for a period of time, after which instantaneous flow replaces it. Applications to measurements of friction head loss and to other paper-mill problems are described. J. G.

541.123.1.012 : 518.3 : 536.423.15 *see Abstr.* 2170

541.123.21 : 547.21 2264

Phase equilibria in hydrocarbon systems. REAMER, H. H., OLDS, R. H., SAGE, B. H., AND LACEY, W. N. *Industr. Engng Chem.*, 36, *pp.* 381–383, *April*, 1944.—The compositions of the liquid phase of lesser density and of the co-existing gas phase of the *n*-butane–water system were determined experimentally throughout the 3-ph. region above 100°F. The volumetric behaviour of a single mixture of *n*-butane and water was studied, and the crit. temp. and pressure of the liquid phase of lesser density were found to be 305·6°F. and 637·5 lb./in.^{2}, respectively.

541.123.3 2265

Phase equilibria in the system ethane–ethylene–acetylene. MCCURDY, J. L., AND KATZ, D. L. *Industr. Engng Chem.*, 36, *pp.* 674–680, *July*, 1944.—The phase equilibrium relations of the ethane–ethylene–acetylene system was studied at 40° and 60°F., and at a series of pressures in 50 lb. intervals covering the entire 2-phase region at each temperature. The constant-boiling mixtures of the ethane-acetylene and ethylene-acetylene systems persist through the triangular 3-component diagrams. At const. temp. and pressure, these diagrams have two 2-phase areas. Acetylene is the most volatile constituent in one area and the least volatile in the other area.

541.123.3 : 542.48 : 518.4 2266

Graphical solution of ternary distillation problems. CORN, L. H. *Industr. Engng Chem.*, 36, *pp.* 378–380, *April*, 1944.

541.124 2267

The mechanism of the diazo-coupling reaction. III. Some unusual coupling phenomena and their interpretation. HODGSON, H. H., AND MARSDEN, E.

J. Soc. Dy. Col., Bradford, 60, *pp.* 120–124, *May*, 1944.—Discusses apparent exceptions to normal coupling behaviour and the explanations advanced for them, in an endeavour to show that the mechanism previously advocated (*ibid.*, 58, p. 228, 1942), that coupling is a condensation between the polarized electrophilic (cationoid) diazo-compound, $R-N^{\delta+}=N-X^{\delta-}$, and the nucleophilic (anionoid) phenol phenoxide, or amino-compound, can provide a satisfactory interpretation of all unusual cases. These special cases are: the coupling of salicylic acid, 4-nitro-2-naphthol, resorcinol, and 1-5-dihydroxy-naphthalene; the mobility of the azo-hydrazone equilibrium as altered by solvents (pyridine and nitro-benzene); the coupling of amino-compounds, incl. aniline and the transformation of diazoaminobenzene into aminoazobenzene; the discoupling of H-acid and the exclusive monocoupling of γ-acid and J-acid; the effect of pyridine on the coupling reaction; the diazo-exchange reaction; and the coupling of phenol ethers. A re-interpretation of ideas is given on the basis of modern electronic and resonance theory.

H. H. HO.

541.124 2268

The mechanism of the reaction of (—)phenyl-alkylcarbinols with hydrogen bromide. ARCUS, C. L. *J. Chem. Soc.*, *pp.* 236–239, *May*, 1944.—Levene and Rothen (*J. Biol. Chem.*, 1939, 127, p. 237), having determined the rotations of the bromides produced by the action of HBr on (—)phenyl-methyl-, -ethyl-, and -*n*-propyl-carbinols at temperatures from — 80° to + 20°, expressed the view that the 3 mechanisms of substitution known as S_Ni, S_N2 and S_N1 do not suffice to explain these curves. An explanation is now put forward in which the participation of each mechanism in the total reaction is represented by a distribution curve about a max. at a certain temperature, and it is found that the algebraic sum of the optical results of the 3 mechanisms reproduces the experimental curves. The domain of each mechanism, represented by the area between its distribution curve and the temp. axis, was calculated for the 3 reactions.

541.124 : 541.621 *see Abstr.* 2306

541.124.7 2269

Molecular compounds between amines and sulphur dioxide. A comment on Jander's theory of ionic reactions in sulphur dioxide. BATEMAN, L. C., HUGHES, E. D., AND INGOLD, C. K. *J. Chem. Soc.*, *pp.* 243–247, *May*, 1944.—Jander's theory of ionic reactions in liquid SO_2 (cf. *Ann. Reports*, 1939, 36, 141) is based essentially on (*a*) the occurrence of reactions in which Cl is displaced as chloride ion from thionyl chloride by means of other anions incl. sulphite ion, and (*b*) a supposed demonstration that amine-SO_2 addition compounds have the structure $[R_3N)_2SO]^{++}[SO_3]^{--}$. Our knowledge of the mechanisms available in substitution processes suffices to show that argument (*a*) does not necessitate the theory; and the chemistry on which argument (*b*) is based is incorrect. The real addition compound of triethylamine and SO_2 is deeply coloured in the liquid state and in solution. It is a weak electrolyte in SO_2. Its mol. wt. in SO_2, as determined by elevation of the b.p. of the solvent, corresponds to the formula R_3NSO_2. It reacts easily with water and oxygen to form colourless triethylammonium salts, chiefly the hydrogen sulphite, hydrogen sulphate, and normal sulphate. Its constitution is discussed, particularly in relation to Weiss's electron-transfer theory of certain types of molecular compound.

541.124.7 2270

The effect of substituents on the dissociation constants of carboxylic acids. SARMOUSAKIS, J. N. *J. Chem. Phys.*, 12, *pp.* 277–288, *July*, 1944.—The electrostatic theory for relative acid strength [Abstr. 2206 (1939)] is extended by the use of an oblate spheroidal molecular model and applied to the study of a number of substituted benzoic acids. When reasonable values of certain structural and electrical parameters, describing the acid and base molecules in equilibrium, are used, the agreement between theory and experiment with respect to the meta acids is good. The theoretically calculated and experimentally determined values of log KA_xB_0 for the parasubstituted acids, where KA_xB_0 is the ratio of the dissociation const. of the substituted acid to that of the parent acid, show differences, $\Delta \log KA_xB_0$, which may be considered measures of the resonance effects operative in the para acids. The quantity $\Delta \log KA_xB_0$ for each acid changes very little from one single-component hydroxylic solvent to another.

541.127 : 541.64 2271

Theory of chain copolymerization reactions. SIMHA, R., AND BRANSON, H. *J. Chem. Phys.*, 12, *pp.* 253–266, *June*, 1944.—The kinetics of chain copolymerizations is developed for reactions consisting of (1) activation of stable monomer; (2) growth of activated polymer radical by monomer addition; (3) stabilization of the growing chains by (*a*) monomer addition, (*b*) by growing polymer. The existence of a steady state in respect to the conc. of growing chains beyond the induction period is assumed. Equations for the rate of change of mole ratio of the two monomer species are developed in terms of mean rates of growth and termination obtained by averaging the actual rates over the distribution of growing polymer. The influence of the type of active chain end involved on overall rate and size distribution is considered by introducing 4 constants for propagation and termination. Special cases according to the rel. magnitude of the rates for the two reactants are presented. Relations are derived for the molecular-size distribution, the inhomogeneity of the copolymer mixture in regard to composition, the average mol. wt. and the average composition of copolymer as function of the composition of the monomer residue.

541.127 : 541.64 2272

Copolymerization of systems of three and more components. ALFREY, T., AND GOLDFINGER, G. *J. Chem. Phys.*, 12, *p.* 322, *July*, 1944.

541.127 : 541.64 : 541.128.24 *see Abstr.* 2278

541.127 : 678.9 2273

Cure of GR-S in thick articles. MORRIS, R. E., HOLLISTER, J. W., AND MALLARD, P. A. *Industr. Engng Chem.*, 36, *pp.* 649–652, *July*, 1944.—A GR-S tread stock cures faster than a Hevea tread stock in thick articles, owing to the higher thermal diffusivity of GR-S stock. The temperature at the centre of thick articles made from GR-S rises higher than the

itside curing temperature, as a result of exothermic action of vulcanization. The temp. coeff. of vulcanation for 10 deg. F. intervals, calculated from modus data, is 1·45 for a GR-S tread stock accelerated th mercaptobenzothiazole and diphenylguanidine.

41.127.032 2274

Mass transfer and chemical reaction in liquid-solid itation. HIXSON, A. W., AND BAUM, S. J. *Industr. ngng Chem.*, 36, *pp.* 528-531, *June*, 1944.—The uble-film concept is applied to a study of the rate dissolution of benzoic acid pellets in dilute aq. aOH. A rate equation is derived which is evaluated graphical integration. Results are expressed in ms of a total effective film thickness, $X_a + X_b$, nich attains a const. value for initial alkali conc. 0·03 *M*. Below 0·03 *M*, the data extrapolate at ro conc. to the film thickness for dissolution of nzoic acid in water. Approximated values for the dividual film thicknesses indicate that the location the neutralization plane is not stationary but moves way from the liquid/solid interface as dissolution oceeds.

41.127.1 : 539.232 2275

The kinetics of the thin oxide film formation of iron d copper. GULBRANSEN, E. A. *Bull. Amer. Phys. oc., April* 28, 1944.—The oxidation measurements re obtained by means of a sensitive vacuum microalance. The temperature regions of 100°–200°C. for u and 200°–450°C. for Fe are covered. The pressure is varied from 0·2 to 0·0002 atm. of O. Several pes of empirical equations fit the data. The form the equation can be correlated with the diffusion henomenon. The influence of temperature, pressure and surface effects, are discussed.

41.127.3 2276

The interaction of oxygen and carbon filaments at igh temperatures. STRICKLAND-CONSTABLE, R. F. *rans. Faraday Soc.*, 40, *pp.* 333–343, *July–Aug.*, 944.—The principal product of the interaction of xygen and graphite between 900° and 2 000°C. is O. Only small amounts of CO_2 are produced. he reaction is of the first order at pressures from ·02 to 0·5 mm. The rate of reaction rises from 00° to 1 100°C., and is const. between 1 600° and 000°C. Between these two ranges there is a zone in hich the rate is very sensitive to the immediate past istory of the filament. When using the filament chnique at high temperatures, precautions must be ken to avoid reactions due to the activation of gas olecules by thermionic emission from the filament. vidence was obtained which does not agree with the ew that O_2 is sorbed in appreciable quantities by a eshly outgassed filament at high temperatures.

41.128 2277

Catalytic formation of methane from carbon onoxide and hydrogen—a study of nickel and nickel lumina catalysts prepared from the hydroxide using otassium, sodium and ammonium hydroxides as preipitants. CHAKRAVARTY, K. M., AND SARKER, J. M. *urr. Sci.*, 13, *p.* 127, *May*, 1944.

41.128.24 : 541.127 : 541.64 2278

Autoxidation of β-eleostearic acid. Application of ie spectrophotometer to the study of the course and the inetics of the reaction. BRAUER, R. W., AND STEADMAN, L. T. *J. Amer. Chem. Soc.*, 66, *pp.* 563–569, *April*, 1944.—A method is described for the study of the autoxidation of fatty acids in liquid solution by O_2 uptake measurements and by the simultaneous determination of the absorption spectra of the autoxidizing solutions. Measurements for β-eleostearic acid suggest that during the reaction a conjugated diene is formed which in turn undergoes autoxidation. A method is described for the computation of the rate of triene destruction employing the O_2 uptake curves and the relation between absorbed O_2 and residual intact triene groups. Results indicate that the initial uptake of O_2 by the acid causes a dimerization involving the formation of some C–C bonds, and that a parasitic polymerization reaction is induced by the peroxides formed in the course of the reaction. N. M. B.

541.128.24 : 541.145 2279

The course of autoxidation reactions in polyisoprenes and allied compounds. VIII. The photo-oxidation of methyl elaidate. SUTTON, D. A. *J. Chem. Soc., pp.* 242–243, *May*, 1944.—Methyl elaidate readily absorbs O at 35° when irradiated by ultra-violet light to form a hydroperoxide ester as the primary product. The oxidation follows the same course as in the case of methyl oleate, the product yielding on catalytic hydrogenation and saponification a mixture of hydroxystearic acids, of which one was isolated in apparently homogeneous condition. Peroxidation is accompanied by some degree of secondary reaction, which leads towards scission of the chain.

541.132 2280

The second ionization constant of deutero-carbonic acid. CURRY, J., AND HUGUS, Z. Z., JR. *J. Amer. Chem. Soc.*, 66, *pp.* 653–655, *April*, 1944.—The const. K_D is found, with the help of available data for $K_H(5{\cdot}61 \times 10^{-11})$, from e.m.f. measurements at 25° of the cells (I)H_2, $KHCO_3$ and (II)D_2, $KDCO_3$ with K_2CO_3, KCl, AgCl, Ag. Results give $K_D = 1{\cdot}42 \times 10^{-11}$ and $K_H/K_D = 3{\cdot}95$, in agreement with predicted values. N. M. B.

541.132 : 537.226.2 2281

The electrostatic contribution to hindered rotation in certain ions and dipolar ions in solution. IV. HILL, T. L. *J. Chem. Phys.*, 12, *pp.* 147–156, *May*, 1944.—The paper is a refinement of earlier papers [Abstr. 693 (1944)] made possible by adopting particular models to represent the shape of molecular cavities. An important consequence is that the effective permittivities used vary with inter-charge distance.

541.132.3 2282

Some factors affecting automatic *p*H control. GREER, W. N., AND CHAPLIN, A. L. *Trans. Electrochem. Soc.*, 83, *pp.* 67–74, 1943.—The effect of rate of flow, volume of reaction tank, time and buffer index on the change in *p*H of a controlled process is considered. Equations are presented for calculating the min. deviation that will occur in a given process before automatic control equipment can begin to make any necessary corrections.

541.132.3 2283

Effect of sodium chloride on the *p*H of *p*-phenolsulphonate buffers from 0° to 60°C. BATES, R. G., AND ACREE, S. F. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 131–144, *April*, 1944.—The e.m.f.'s developed between the H and $AgCl_2$ electrodes of galvanic cells

which contained 12 mixtures of K *p*-phenolsulphonate NaOH and NaCl were measured from 0° to 60°C. at intervals of 5 deg. Sufficient alkali was used to neutralize $^1/_2$ of the phenolsulphonate in each solution. The molal ratios of NaOH to NaCl were 10, 4, 2 and 1. The *p*H of each solution, and of 6 phenolsulphonate buffers without NaCl, was determined. Equations are given to represent the change of *p*H at each of the 13 temperatures with molality of NaCl. The ionic strength and *p*H of unknowns may be obtained approx., and the usual salt errors largely eliminated, from e.m.f. measurements on 2 portions of the unknown solution to which different amounts of NaCl have been added.

541.132.3 2284

A method for the determination of the *p*H of 0·05-molal solutions of acid potassium phthalate with or without potassium chloride. HAMER, W. J., AND ACREE, S. F. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 215–228, *May*, 1944.—A method is described for the determination of the *p*H directly from the e.m.f. by the equation

$$p\mathrm{H} = [(E - E^\circ)/(RT/F)] + \log m_{\mathrm{Cl}} - P/Q$$

where P and Q are constants whose numerical values depend on the ionic strength of the solution and the nature of the cation and E°, R, T and F have their usual significance. By this method a 0·05 *m* sol. of acid K phthalate, is found to have a *p*H of 4·008 at 25°C. A description is given of the application of the method to the determination of the *p*H and the ionic strength of unknown solutions of low salt content. Equations were formulated to express the variation of the *p*H of a 0·05 *m* sol. of acid K phthalate with temperature and with conc. of KCl. The *p*H values may be computed from 0° to 60°C. by $p\mathrm{H} = 5\cdot13 \log T + 1\,519\cdot62/T + 0\cdot01092\,T - 17\cdot039$, where $T = t^\circ\mathrm{C.} + 273\cdot16$. The *p*H values for conc. of KCl from 0 to 0·05 *m* may be computed by

$$p\mathrm{H}_{\text{with salt}} = p\mathrm{H}_{\text{without salt}} - 0\cdot993 m_{\mathrm{KCl}} + 2\cdot124 m_{\mathrm{KCl}}^2$$

541.135.62 2285

Mechanism of copper passivation in alkaline solutions of oxidizers. SAMARTZEV, A. G. *C.R. Acad. Sci. URSS*, 35, 2, *pp.* 38–42, 1942.—The author has carried out experiments to study the passive behaviour of Cu in alkaline solutions of $K_2S_2O_8$. The conclusions are that passivity is due to the formation of a thin protective film of CuO, of which the thickness and structure depend on the experimental conditions: and, further, that the formation of this film is a result of the crystallization of CuO from the solution of an unstable compound, Na_2CuO_2, which forms about the metallic surface during the first stage of the process initiated by the action of the liquid upon the metal. A. E. T.

541.139 : 538.69 *see Abstr.* 2212

541.141 : 581.035.2 2286

Effect of intermittent irradiation on photoperiodic responses. WITHROW, R. B., AND WITHROW, A. P. *Plant Physiol.*, 19, *pp.* 6–18, *Jan.*, 1944.—Several series of experiments are described in which intermittent irradiation was used to determine the relation betw. photochemical and non-photochemical reactions associated with photoperiodism. Six species of plants were used and the results discussed. A theory is postulated concerning the kinetics of the photoperiodic reaction based on (1) the slow rate of the non-photochemical reaction which forms the substance to be photo-activated, and (2) the low equilibrium conc. which this substance attains during long periods of darkness. C. J. G.

541.141.1 2287

The photo-reduction of ferric chloride in presence of aqueous acetone and anhydrous ether. PRASAD, M., AND BAVDEKAR, P. R. *Proc. Indian Acad. Sci. A*, 18, *pp.* 373–382, *Dec.*, 1943.—The photo-reduction of Fe_2Cl_6 in presence of aq. acetone and anhydrous ether is a unimolecular reaction. The temperature and the frequency of the exciting radiations have a marked effect on the velocity const. of the reaction. The rate of reaction is $\propto$ the intensity of the incident light. The quantum yield of the reaction increases with dilution of Fe_2Cl_6, the temperature and the frequency of the exciting radiations, and is of the order of 0·5 for acetone and 1·0 for ether.

541.145 : 541.128.24 *see Abstr.* 2279

541.147.7 : 771.534 2288

Sensitometric apparatus for controlling the manufacture of photographic materials. DAVIES, E. R. *Photogr. J.*, 84, *pp.* 185–193, *June*, 1944.—An account of some recent advances on the instrumental side. After discussing the aims of sensitometric measurement, 3 types of sensitometer are described. Special light sources and developing machines are discussed whilst details are also given of 3 types of densitometer. An accuracy of $\pm 2\,^1/_2\%$ is obtained in a single measurement of speed, and it is considered that of this $\pm 1\%$ gives the total instrumental error. A. H.

541.18.041.2 2289

Flocculation in solutions and suspensions. MARDLES, E. *Nature, Lond.*, 153, *pp.* 746–747, *June* 17, 1944.—[See Abstr. 1398 (1942)].

541.182 : 532.133 = 3 2290

On the form of the relation between viscosity and particle size, especially in solutions of eucolloidal substances. OSTWALD, WO. *Kolloid Z.*, 106, *pp.* 1–22 *Jan.*, 1944.—The literature on the subject is surveyed and graphs of the function are discussed. The curves are either of single or double S shape. Dissolution of solid organic substances in liquids may either increase or decrease the viscosity. R. N.

541.182.02 2291

Fibre structure in dispersions of soap in mineral oil. GALLAY, W., PUDDINGTON, I. E., AND TAPP, J. S. *Canad. J. Res. B*, 22, *pp.* 66–74, *May*, 1944.—A new method is described for the examination of soap fibres dispersed in oils or greases by the study with transmitted or polarized light of specially treated samples on microscope slides. Data and photographs of soap fibres are given. The development of large fibres is discussed and the growth of fibres by orientation and overlapping of smaller fibrils is described. Evidence is adduced by micro-manipulator examination of soap and non-soap fibres in mineral oil. The effect of glycerol, present in grease made from fats, is essential for the production of long fibres in ordinary practice, and this effect is ascribed mainly to the ability of oil to wet the soap in the presence of glycerol. N. M. I.

41.182.025 2292

Thixotropy in silver amalgams. HUDSON, D. R. *Phys. Rev.*, 65, *pp.* 247–248, *April* 1 *and* 15, 1944.

41.182.025 : 539.501 : 532.137 2293

The effect of thixotropy on plasticity measurements. GREEN, H., AND WELTMANN, R. N. *J. Appl. Phys.*, 15, *pp.* 414–420, *May*, 1944.—The paper is devoted to laboratory procedures, i.e. to find a process whereby plastic viscosity and yield value can be recorded at a known thixotropic level. The coefficients of thixotropic breakdown are calculated. The viscometer used for producing the hysteresis loop is of the rotational type, in which the distance between the cup and bob is sufficiently small to give satisfactory linear flow curves for plastic materials, and so constructed that rapid changes can be made in the rotation of the cup. The r.p.m. can be varied from 5 to 400, and the apparatus is capable of giving consistency curves covering materials with viscosities from 1 to 2 500 poises and yield values up to 180 000 dynes/cm.^{2}. Materials like printing inks fall within this range. It is necessary that the material be properly conditioned so that measurements are started always from the same level, and directions are given for this purpose. To show the efficiency of the method, the experimental results obtained by 6 investigators using 6 different viscometers are included. H. H. HO.

541.182.05 : 662 2294

Laboratory and field tests on coal-in-oil fuels. BARKLEY, J. F., HERSBERGER, A. B., AND BURDICK, L. R. *Trans. Amer. Soc. Mech. Engrs*, 66, *pp.* 185–198, *April*, 1944.—A stable suspension of coal in oil for practical purposes can be prepared by dispersing 40% coal by weight ground from 98 to 99% through a 230-mesh screen in heavy fuel oil. Careful control of storage and handling temperatures is required. Combustion efficiency is slightly less than that of fuel oil.

541.182.2.053 2295

Gas-liquid contacting by mixers. FOUST, H. C., MACK, D. E., AND RUSHTON, J. H. *Industr. Engng Chem.*, 36, *pp.* 517–522, *June*, 1944.—The amount of air held up in bubble form in a cyl. tank with water was measured and is useful in estimating the ability of mixers to disperse gases in liquids. A "contact time" is related to power input and air velocity for one ratio of tank to impeller dia. The tanks were baffled, and the disperser was rotated on a vertical shaft on the tank axis. Liquid quantities ranged from 5 to 2 250 gal. Air flows ranged from 1 ft./min. superficial to 5 ft./min.

541.182.4 2296

Permanence and stability of emulsion systems. AHERNE, J. C., AND REILLY, J. *Nature, Lond.*, 154, *pp.* 86–87, *July* 15, 1944.—A water-in-liquid-paraffin emulsion system has been described [Abstr. 2132 (1944)], which showed good permanence when left undisturbed but deteriorated at once by coalescence of the water-globules of the sample into pools when very slightly disturbed. If the normal factor obtained as a result of size-frequency analyses at various time-intervals be called a stability factor for such a system, it would be very misleading. Accordingly it is proposed to call such a term a "factor of permanence," when measured under conditions which are against undue mechanical disturbance. H. H. HO.

541.182.4 : 532.695.1 *see Abstr.* 2132

541.182.5 : 535.434 2297

Studies of the optical properties of gels. I. Thorium molybdate gels. II. Thorium arsenate gels. III. Silicic acid gels. PRASAD, M., AND GURUSWAMY, S. *Proc. Indian Acad. Sci. A*, 19, *pp.* 47–87, *Jan.*, 1944.—The changes in the intensity and depolarization factors of the light transversely scattered was investigated in each case. Measurements of the value of, and a comparison of, the backward and forward scatterings show that the size of the gel particle is $<\lambda$. An approx. estimate, obtained by comparing the intensity of scattered light at 45° and 135° to the incident light, shows that the size of the particles is $\sim \frac{1}{4}\lambda$. Since the size of the particles is $< \lambda$, a calculation of density scattering and anisotropy scattering, separately, from the total observed scattering, and their changes during gelation, shows that the density scattering increases during gel formation, thus indicating that gelation is analogous to coagulation. The anisotropy scattering decreases in I, but increases in II and III during gelation; in I it is $>>$, and, in II and III $<$, the density scattering. There are no great changes in the final vols. of the gel particles formed under different conditions of gel formation. Krishnan's formula connecting ρ_v, ρ_h and ρ_u holds good in I and fairly good in II and III. The process of formation and the effect of different constituents of the gel-forming mixture on the course of gel formation is discussed in detail. N. M. B.

541.182.6.041 2298

Rate of sedimentation. Non-flocculated suspensions of uniform spheres. STEINOUR, H. H. *Industr. Engng Chem.*, 36, *pp.* 618–624, *July*, 1944.—The effect of conc. on the rate of fall of uniform well-dispersed spheres is investigated theoretically and experimentally. Tests with suspensions of tapioca particles in oil provide empirical solutions of functions of conc. left undetermined by the theoretical analysis. Tests with fairly uniform microscopic glass spheres support the conclusions drawn from the tests with the larger tapioca particles.

541.182.6.046 = 3 2299

The ion exchange in colloidal sulphur. I. Contribution to the study of the ion exchange in lyophobe colloidal systems. VERSTRAETE, E. O. K. *Kolloid Z.*, 102, *pp.* 259–267, *March*, 1943.—After discussing the preparation and cleaning, and the properties and constitution, of the pure S sol, the author investigates the stability conditions in the presence of electrolytes and of H_2S and the influence of cations and anions, and of concentration, on stability. As a criterion, the coagulation value (conc. of electrolyte at which distinct turbidity occurs) is determined. The influence of the ions on the electric charge of the S sol, the S coagel and the solubility of the polythionates formed during the preparation of the sol, are investigated. R. N.

541.183.2 2300

Studies on adsorption in relation to constitution. I. Adsorption of alkaloids by silica gel. II. Adsorption of organic acids on activated silica gel. GYANI, B. P., AND GANGULY, P. B. *Bull. Patna Sci. Coll.*,

No. 14, *pp.* 26–49, *Jan.*, 1944.—A study of adsorption of 7 alkaloids from alcoholic solutions on silica gel shows considerable absorption of the alkaloids, the process following Freundlich's equation. The attainment of equilibrium is slow, the temp. coeffs. of adsorption are generally large, and similarly constituted alkaloids give comparable adsorption coeffs. A parallelism between physiological activity and adsorption is observed. Measurements of the adsorption of 13 monobasic fatty acid homologues by silica gel show that formic acid gives an abnormally large adsorption of 92%; the other acids from acetic to stearic give vals. betw. 52·8 and 60%; this contrasts with adsorption on C which follows Traube's rule. Variation of adsorption with different solvents and conc. of acid, effect of substitution by OH or halogens in a series of mono- or di-basic acids, and of substitution of different groups in acetic, benzoic and succinic acids, are tabulated and discussed. N. M. B.

541.183.2 : 532.691 2301

The properties of freshly formed surfaces. II. The rate of adsorption of *iso*-amyl alcohol at the air/water surface. ADDISON, C. C. *J. Chem. Soc.*, *pp.* 252–256, *May*, 1944.—The vibrating-jet technique was applied to the study of the rate at which surface equilibrium of *iso*amyl-alcohol–water mixtures is established. Dynamic tensions at surface ages of the order of 10^{-2} sec. are recorded for various concentrations, and the velocity at which adsorbate molecules migrate to the surface is calculated.

541.183.25 : 547.458.6 2302

Water sorption by cornstarch and commercial modifications of starches. SAIR, L., AND FETZER, W. R. *Industr. Engng Chem.*, 36, *pp.* 316–319, *April*, 1944.—Sorption isotherms of cornstarch and 10 of its commercial modifications were determined. Modification up to a 60-fluidity thin-boiling starch results in apparently little hydration change. Dextrinization, with or without acid catalyst, results in products with different hydration characteristics. There is little correlation between the viscosity of the modified products and their hydration capacity.

541.265 : 539.133 : 541.6 *see Abstr.* 2304

541.57 2303

Spectroscopic evidence for the N–H–N bond in ethyleneimine. THOMPSON, H. W., AND HARRIS, G. P. *J. Chem. Soc.*, *pp.* 301–303, *June*, 1944.—The infra-red absorption spectrum of solutions of ethyleneimine in CCl_4 in the region of 3 μ was measured, and the results suggest the occurrence of association through *N*–H–N bonds. Other experimental results support this conclusion.

541.6 : 541.265 : 539.133 2304

Molecular constants and chemical theories. I. The parachor (molecular volume). II. Additive molecular constants and chemical structures. SAMUEL, R. *J. Chem. Phys.*, 12, *pp.* 167–202, *May*, 1944.—Additive molecular constants are capable of being consistently interpreted in various different ways. A number of equivalent but discordant theories of valency are possible. The choice between them is arbitrary. The mol. vol. in terms of the parachor is studied in detail. A new set of atomic parachors is calculated on the basis of classical formulae. Instead of resorting to different types of bonds and their respective parachor constants, it ascribes different constants to the same atom in different valence states. The contributions of the constituent atoms to the volume of the covalent molecule thus calculated bear a close relation to their atomic numbers and to their ionization potentials. All additive mol. constants, besides parachor and mol. refractivities, may be separated into individual contributions according to different proposed structures of a covalent molecule or different chemical theories on which these structures are based. A number of std. examples of molecules formed by a marked central atom are considered, which often are assumed to establish the existence of a second variety of covalent linkage or its wave-mechanical counterpart. For all of them, all the mol. constants are in perfect agreement also with the older classical formulae.

541.621 : 535.34-31 2305

Effects of beta-carotene isomerization on its absorption at 326 millimicrons. SCHRENK, W. G., SILKER, R. E., AND KING, H. H. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *p.* 328, *May*, 1944.—The isomerization of β-carotene is responsible for the wide range of correction values reported for vitamin A analysis in the ultra-violet. The correction required at 326 mμ for β-carotene in Skellysolve B was calculated and shown to be a linear function of % isomerization.

541.621 : 541.124 2306

The isomerization of some aromatic ketones with aluminium chloride. BADDELEY, G. *J. Chem. Soc.*, *pp.* 232–236, *May*, 1944.—These isomerizations are of two types; the mechanism of each was determined, and the factors controlling the rel. amounts of isomerization of each type are indicated. The migrations of alkyl groups in benzene homologues, phenols, aryl ketones and hydroxyaryl ketones are related to one another and to the Jacobsen reaction.

541.64 : 541.127 *see Abstr.* 2271, 2272

541.64 : 541.127 : 541.128.24 *see Abstr.* 2278

541.651 : 530.145.6 = 3 *see Abstr.* 2110

542.3 : 531.75 *see Abstr.* 2116

542.41 2307

Bomb furnace for Carius digestion. GREENBERG, L. A. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *p.* 308, *May*, 1944.

542.48 : 518.4 : 541.123.3 *see Abstr.* 2266

542.78 2308

A high-vacuum connection. MOORE, M. J. *J. Sci. Instrum.*, 21, *pp.* 124–125, *July*, 1944.

542.8 2309

Glass electrode assembly for titrating microbiological vitamin assays. MCQUARRIE, E. B., AND KONEN, H. J. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 205–207, *March* 15, 1944.

544.8 : 621.317.39 2310

An electronic indicator for liquid separation. BROADHURST, J. W. *J. Sci. Instrum.*, 21, *pp.* 108–109, *June*, 1944.—[Abstr. 1677 B (1944)].

545.37 2311

Systematic polarographic metal analysis. LINGANE, J. J. *Industr. Engng Chem.* (*Analyt. Edit.*), 16, *pp.* 147–152, *March* 15, 1944.—The best supporting

ectrolyte for the simultaneous polarographic deter-ination of Cu, Bi, Pb and Cd contains 0·4 *M* Na artrate, 0·1 *M* Na hydrogen tartrate, and not more an 0·005% gelatin as a max. suppressor. Conc. of elatin > 0·03% obliterate the Bi wave. When one or ore of the nobler members of the group predomi-ates and thus interferes with the polarographic etermination of the others, the interfering con-ituents may be removed by electrolysis with a Hg athode at a carefully controlled potential, and the inor baser metals are then determinable in the sidual solutions. Apparatus and technique are escribed in detail, and the efficiency of the method is lustrated by examples. [See Abstr. 450 (1944)].

45.37 2312

Potentiometric determination of acidity in highly oloured materials. LYKKEN, L., PORTER, P., RULIFF-N, H. D., AND TUEMMLER, F. D. *Industr. Engng hem.* (*Analyt. Edit.*), 16, *pp.* 219–234, *April* 20, 944.—Potentiometric methods are particularly ap-licable where acidimetric colour titration indicators ail (used lubricants, lubricants containing oxidation nd corrosion inhibitors, detergents, fats and other dditives). Titration is made directly or after aponification with KOH in a single-phase solution f the sample in a non-aq. solvent (benzene-isopropyl-lcohol) containing approx. 0·5% water, using a glass-alomel electrode system. The determination by a ingle titration of 2 or more components of a mixture f acids or bases not distinguishable in an aq. titra-ion, and phenomena which make possible the estima-ion of ionization constants of acids and bases having imited solubility in water, are briefly described.

545.721 : 535.37 *see Abstr.* 2150

545.8 : 547.5 : 532.77 *see Abstr.* 2135

545.824 : 539.26 *see Abstr.* 2335

545.844 : 547.53 2313

Analytical determination of aromatic hydrocarbons y adsorption. MAIR, B. J., AND FORZIATI, A. F. *. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 151–164, *April*, 1944.—The mixture to be analysed is filtered hrough a column of solid adsorbent. An aromatic-ree filtrate is obtained which contains the paraffin, aphthene or olefin hydrocarbon which was asso-iated in the original solution with the quantity of romatic hydrocarbon which has been adsorbed. The conc. of an aromatic hydrocarbon in an unknown olution is determined by a calibration curve. If the emperature is controlled to within 1°C., the amount f aromatic hydrocarbon can be determined with an ccuracy corresp. to 0·10 or less in the vol. %.

545.844 : 547.53 2314

Separation and recovery of aromatic hydrocarbons rom paraffins and naphthenes by adsorption. MAIR, B. J., AND FORZIATI, A. F. *J. Res. Nat. Bur. Stand., Wash.*, 32, *pp.* 165–183, *April*, 1944.—The mixture is ntroduced into the top of a column containing an appropriate excess of solid adsorbent. A low-oiling paraffin hydrocarbon is added in sufficient quantity to remove from the column the paraffin and naphthene hydrocarbons but not the aromatic hydro-arbons. The latter are then removed by adding an appropriate desorbing liquid. Determinations were made of the quantity of aromatic hydrocarbon adsorbed per unit quantity of adsorbent, for a number of different binary solutions of aromatic hydrocarbons with paraffins or naphthenes, at several concentrations of the aromatic hydrocarbon, and with silica gel, carbon, magnesia, alumina, Filtrol and Florisil as adsorbents.

546.11 : 537.534.7 : 537.561 *see Abstr.* 2202, 2203

546.17 : 535.338.4 *see Abstr.* 2143

546.391.31 : 536.77 *see Abstr.* 2182

546.791 : 539.163 : 539.185 = 3 *see Abstr.* 2224

546.821 : 539.172 *see Abstr.* 2221

546.831 : 536.631 *see Abstr.* 2175

546.841 : 535.338 = 3 *see Abstr.* 2142

547.21 : 541.123.21 *see Abstr.* 2264

547.458.6 : 541.183.25 *see Abstr.* 2302

547.5 : 536.421 *see Abstr.* 2169

547.5 : 545.8 : 532.77 *see Abstr.* 2135

547.53 : 545.844 *see Abstr.* 2313, 2314

548.0 : 535.4 2315

A method of calculating the integral breadths of Debye–Scherrer lines: generalization to non-cubic crystals. STOKES, A. R., AND WILSON, A. J. C. *Proc. Camb. Phil. Soc.*, 40, *pp.* 197–198, *June*, 1942.—A formula, generalizing an earlier result [see Abstr. 2628 (1942)], is established for the integral breadths in the case of crystals of any symmetry. L. S. G.

548.0 : 538.22 2316

The principal magnetic susceptibilities of metal crystals. RAO, S. R. *Curr. Sci.*, 13, *pp.* 125–126, *May*, 1944.

548.0 : 539.11 2317

Asymptotic formulae relating to the physical theory of crystals. LEDERMANN, W. *Proc. Roy. Soc. A*, 182, *pp.* 362–377, *June* 16, 1944.—The results obtained from the physical theory of crystals worked out by Born, assuming his cyclic condition (i.e. the crystal is cyclically closed and boundary particles are neglected), are shown to be consistent with those obtained from the rigorous treatment in which a distinction is drawn between boundary and internal particles, as long as the number of boundary particles is sufficiently small compared with the number of internal particles. J. T.

548.0 : 553.621 2318

The Q lap. SCHAFFERS, T. W. M. *Communications*, 24, *pp.* 40–42 *and* 80, *April*, 1944.—Describes a recently developed automatic machine for grinding quartz crystals. Two blanks, held in place on a rocking arm by air suction, are ground simultaneously by a diamond-dust wheel. Fast grinding is obtained by using 100-grit size diamonds in a resin-bonded wheel; a coolant with 20–30% turpentine and 70–80% kerosene gives a fine surface, with scratches 0·00055 in. deep, requiring only final lapping. Dimensional accuracy of 0·00025 in. is achieved. C. F. B.

548.24 2319

Use of the etch technique for determining orientation and twinning in quartz crystals. WILLARD, G. W. *Bell Syst. Techn. J.*, 23, *pp.* 11–51, *Jan.*, 1944.—A

survey. Describes electrical and optical twinning, also the rare combined twinning; and discusses the etch method of determining orientation, which is commonly used in conjunction with X-ray and optical methods. Hints on the actual process of etching are given and the determination of orientation by the examination of etch pits by reflected light and by parallel and divergent transmitted light is considered. Instruments by which this examination may be carried out are described and illustrated. A simple apparatus is also described for the detection of twinning and the determination of right- or left-handedness without determination of the orientation.

J. T.

548.73 2320

The crystal structure of boron carbide. CLARK, H. K., AND HOARD, J. L. *J. Amer. Chem. Soc.*, 65, *pp.* 2115–2119, *Nov.*, 1943.—The structure proposed by Zhdanov and Sevast'yanov [Abstr. 1888 (1944)] is confirmed. The rhombohedral lattice constants are $a = 5{\cdot}19$ Å and $\alpha = 66°\ 18'$, space-group $D_{3d}^5 - R\bar{3}m$, with 3 stoichiometric B_4C molecules within the unit cell; the corresp. hexagonal lattice constants are $a = 5{\cdot}60$ Å and $c = 12{\cdot}12$ Å for a cell containing 9 molecules. The structural units are a linear chain of 3 C atoms and a group of 12 B atoms at the vertices of a nearly regular icosahedron.

548.73 2321

X-ray crystallography of gliotoxin. CROWFOOT, D., AND ROGERS-LOW, B. W. *Nature, Lond.*, 153, *pp.* 651–652, *May* 27, 1944.

548.73 2322

The dissociation of an alloy of copper, iron and nickel. Further X-ray work. DANIEL, V., AND LIPSON, H. *Proc. Roy. Soc. A*, 182, *pp.* 378–387, *June* 16, 1944.—The intermediate structures formed during the dissociation of Cu_4FeNi_3 [see Abstr. 2628 (1943)] were not previously determined since the calculated X-ray intensities were not in satisfactory agreement with those observed, although it was believed that the atomic positions were not far wrong. It is now shown that the intensities are modified in a systematic way by extinction; and, after making allowance for this, all the observed data can be accounted for. There is a periodic variation of the lattice parameter and, on prolonged annealing, it is possible to follow the wavelength and amplitude of this as a function of time and temperature over a considerable interval. Details of this variation are given and the bearing of the observations on the kinetics of phase change is discussed.

J. T.

551.579.5 : 532.685 *see Abstr.* 2130

553.621 : 548.0 *see Abstr.* 2318

576.351 = 3 2323

On the duplication of the cell nucleus and gens and the total gens number in the nucleus and chromosome. KOYENUMA, N. *Z. Phys.*, 119, 7–8, *pp.* 522–526, 1942.—Reports on the mechanism of the duplication from the standpoint of the forces which come int play, on the model of the water drop. Formulae ar given which enable the gens number in the ce nucleus, and in the chromosome, to be computed.

H. G. S

576.72 : 535.43 *see Abstr.* 2155

576.8.095.14 : 614.71 : 535.21-31 *see Abstr.* 2139

578.087 : 531.787 *see Abstr.* 2119

578.087.87 : 537.29.047 *see Abstr.* 2184

581.035.2 : 541.141 *see Abstr.* 2286

581.037 : 537.362 *see Abstr.* 2188

591.465.14 : 539.217 *see Abstr.* 2227

595.771 : 538.569.047 = 4 *see Abstr.* 2211

612.84 : 535.7 = 3 *see Abstr.* 2158

614.71 : 576.8.095.14 : 535.21-31 *see Abstr.* 2139

662 : 541.182.05 *see Abstr.* 2294

662.66 : 539.501 *see Abstr.* 2257

669.018 : 539.377 : 539.24 *see Abstr.* 2233

669.13 : 536.413.2 *see Abstr.* 2168

669.71 : 536.7 *see Abstr.* 2180

676 : 539.217.5.08 *see Abstr.* 2229/2232

676 : 539.4.019 *see Abstr.* 2253

676 : 539.42 *see Abstr.* 2255

677 : 536.212.3 *see Abstr.* 2164

677.31 : 539.216.1 : 539.388.8 = 3 *see Abstr.* 2244

677.31 : 539.388.8 *see Abstr.* 2245

678 : 539.26 *see Abstr.* 2236

678 : 539.31 *see Abstr.* 2239

678 : 539.389.3 *see Abstr.* 2247, 2248, 2249

678 : 539.389.4 *see Abstr.* 2250, 2251

678 : 539.501 *see Abstr.* 2258, 2259

678.5 : 539.413 *see Abstr.* 2254

678.7 : 539.382 *see Abstr.* 2242

678.9 : 539.501 *see Abstr.* 2260, 2261

678.9 : 541.127 *see Abstr.* 2273

679.5 : 536.413 *see Abstr.* 2167

679.5 : 539.2 : 539.388.8 *see Abstr.* 2243

679.5 : 539.3 *see Abstr.* 2238

679.5 : 539.319 *see Abstr.* 2240

679.5 : 539.389.4 *see Abstr.* 2252

679.56 : 535.551 : 539.38 *see Abstr.* 2241

681.14 : 518.5 : 535.51.06 *see Abstr.* 2156

681.2 : 53 *see Abst.* 2106

691.11 : 539.388.8 *see Abstr.* 2246

771.53 : 537.531 *see Abstr.* 2194

771.534 : 541.147.7 *see Abstr.* 2288